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The Journal

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AMERICAN DENTAL ASSOCIATION

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Impacted Third Molar—*Repass*

Hypertrophic Gingivitis—*Coolidge*

Background of Paradentosis—*Becks*

Endocrine Factors—*McCullagh and Resch*

Silicates: Zinc Phosphate Cements—*Roush*

Dental Need and Care—*Klein and Palmer*

Technic for Taking Impressions—*Atkinson*

Uniform Amalgam Restorations—*Sweeney*

Influence of Heat Treatment—*Peyton*

Intermaxillary Distance—*Junemann*

Partial Denture Design—*Girardot*

SEPTEMBER 1941

CONTENTS

Willard F. Andes, D.D.S. ..... Frontispiece

ORIGINAL COMMUNICATIONS

Hypertrophic Gingivitis.
Edgar D. Coolidge, M.S., D.D.S. 1381
History and Development of Partial Denture Design.
Raymond L. Girardot, D.D.S. 1399
The Impacted Mandibular Third Molar.
Fred G. Repass, D.D.S., M.S.D. 1409
Pits and Fissures in the Permanent Teeth: Their Treatment.
Thomas A. Gardner 1415
The Silicates; with a Reference to Zinc Phosphate Cements.
J. W. Roush, D.D.S. 1421
Consequences of Shortening the Intermaxillary Distance.
Henry R. Junemann, D.D.S. 1427
Some Endocrine Factors in Dental Development and Maintenance.
E. Perry McCullagh, M.D., and Charles A. Resch, D.D.S. 1436
Systemic Background of Paradentosis.
Hermann Becks, Dr.med., Dr.med.dent., D.D.S. 1447
Some of the Responsibilities of the Orthodontist to the Dentist, the Parent and the Patient.
Bruce A. Curran, D.D.S. 1460
An Improved Technic for Packing and Condensing Uniform Amalgam Restorations by Hand.
James T. Sweeney, D.D.S. 1463
Extra-Oral Roentgenographic Technics, Using the Casette Table.
D. W. Lovett, D.D.S. 1472
Salivary Calculi.
W. I. Jones, D.D.S. 1477
A New Technic for Taking Impressions for Stable Lower Dentures.
Lee W. Atkinson, D.D.S. 1478
The Disparity Between Dental Need and Dental Care in School Children of Hagerstown, Md., and Environs.
Henry Klein, D.D.S., and Carroll E. Palmer, M.D. 1489
The Influence of Heat Treatment on Partial Denture Structures.
Floyd A. Peyton, Sc.D. 1499

EDITORIAL DEPARTMENT

Rehabilitation 1507
"A Study of the Dental Needs of Adults in the United States" 1511

Bibliographical 1511

ASSOCIATION ACTIVITIES

President's Page—National Health Program Committee—Committee on Dental Preparedness—Council on Dental Therapeutics—Bureau of Public Relations—Committee on Legislation—Dental Museum—Research Commission—Committee on Economics—A.D.A. Annual Meeting—American Dental Association Membership—News Item ..... See Special Contents for Association Activities, page 1514

OBITUARIES

John A. Marshall, D.D.S. (1884-1941) 1556
Abraham Lincoln Greenfield, D.D.S. (1898-1941) 1557
William Hopkinson, D.D.S. (1863-1941) 1557
Deaths 1558

Current Literature 1559
Announcements 1564

ADVERTISEMENTS

Index to Advertisements A-63
Classified Section A-44

The Journal of the American Dental Association. Vol. 28, No. 9. Published by the American Dental Association, 212 East Superior Street, Chicago, Ill. Yearly subscription $5.00. Single copy fifty cents. Entered as second-class matter, January 30, 1939, at the postoffice at Chicago, Ill., under the act of August 24, 1912. Published monthly.

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HYPERTROPHIC GINGIVITIS

By EDGAR D. COOLIDGE, M.S., D.D.S., Chicago, Ill.

NO better introduction to the study of hypertrophic gingivitis can be given than to quote the statement of Francis P. McCarthy, of Boston,[1] made before the Section on Dermatology and Syphilology of the American Medical Association at the meeting in New York in June 1940:

> The oral cavity has always been a "no man's land" as far as any group of physicians or dentists can claim a special knowledge of the multitude of lesions found in this domain. As the mouth reflects in many instances disease processes elsewhere in the body, it can well be considered the "diagnostic mirror" of the body.
>
> No group of medical specialists is better fitted by training to lead the way in stimulating interest in diseases of the mouth than the dermatologist. The dentist, however, should by election become the diagnostician and be recognized as a stomatologist rather than one whose knowledge is confined to the teeth alone.

The challenge embodied in the statement made above should inspire in the members of our profession a desire for a broader understanding of the many lesions of the oral cavity, some of which are quite commonly observed in general practice and others less frequently seen but often more serious in character.

Hypertrophic gingivitis, or as frequently termed hyperplasia of the gingivae, is an abnormal enlargement or overgrowth of the gingival tissues. A simple localized inflammatory type is most commonly observed, while another type is quite frequently associated with some systemic disorder or disturbed glandular function. The two types are often inseparable from the etiologic standpoint and are identified by the general systemic condition, which is looked upon as a predisposing factor, at least in most instances, while the local manifestation in the gingivae is more or less influenced by the local irritation present at the initiation of the lesion.

From histologic study of resected gingival tissues, three types of tissue reactions will be discussed. The number of cases examined is not sufficient to cover all of the lesions that may be found in

From the Foundation for Dental Research of the Chicago College of Dental Surgery, Dental Department of Loyola University.

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the gingival tissue, but these three types of tissue reaction appear to be distinctly characteristic.

HISTOLOGIC INVESTIGATION

Histologic study was made of the resected gingivae of a young girl in whose mouth local irritation from neglect of hygiene seemed to be the etiologic factor (Fig. 1). A typical picture of chronic inflammation was found in the subepithelial tissue, with acute inflammation in the superficial layers of cells are missing. In higher magnification, masses of plasma cells and lymphocytes (Figs. 3, 4 and 5) appear in groups, which gives the connective tissue a cellular rather than a fibrous appearance, while, in the deeper layers, the fibrous element in the connective tissue seems to be hyperplastic. The fact that the girl was 14 at the time of removal of the tissue points toward a possible hormonal disturbance as a predisposing factor and suggests

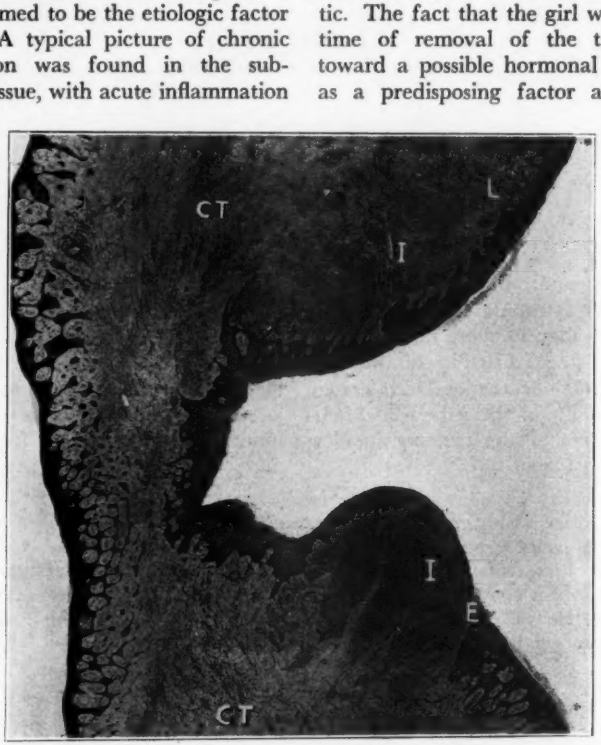

Fig. 1.—Hypertrophic gingival tissue resected from 15-year-old girl. (Compare Figure 12, A.) I, chronic inflammatory area in connective tissue; CT, hyperplastic area showing less infiltration of round cells and more fibrous tissue; E, unhornified epithelium with leukocytes showing on surface; L, leukocytes migrating through epithelium.

in the superficial tissue (Fig. 2). Many leukocytes are present and, in some places where the epithelium is thin (Fig. 3), a mass of leukocytes can be seen very close to the surface and escaping into the oral cavity. The surface of the epithelium is unhornified and the keratohyaline granules that are usually seen

that the gingival tissues might have been more susceptible to irritation at this period.

In the study of hyperplasia of the gingivae of a boy aged 14 (a patient of E. A. Archer, of Chicago) (Fig. 6), who had been under treatment with dilantin sodium to control the convulsions of

epilepsy during twenty-four months, quite a different histologic picture was found from those wherein local irritants are the primary factor. There is a characteristic irregularity of the epithelium which manifests itself in proliferations from the basal layer into the hyperplastic subepithelial tissue. An unusually well-keratinized layer lines the outer surface (Fig. 7). Masses of round cells surround the proliferated epithelium and, in higher magnification, are found to be mostly plasma cells and lymphocytes (Fig. 8). There are many fibroblasts throughout the connective tissue. The connective tissue is not generally infiltrated with round cells, but they appear in spots, especially where the epithelium projects deeply into the connective tissue (Fig. 6). The epithelial cells flatten out toward the corneal layer and, as they approach the surface, the outer layers of nucleated cells are very well filled with keratohyaline granules (Fig. 9). The surface of the epithelium consists in an unusually thick layer of hornified cells without nuclei. This accounts for the high resistance of this hypertrophic tissue, without pain or hemorrhage, when irritated by food or the toothbrush.

It is not possible to state at this time what percentage of cases of gingival hyperplasia caused by the treatment of epilepsy with dilantin sodium will be found to conform to this description, and it is quite probable that the histologic characteristics of the tissue proliferation would vary with the character and the amount of local irritation. In the report of Glickman and Lewitus,[2] attention is called to histologic characteristics of a case under their observation and study similar to those observed in the case in this report.

A third histologic type of hyperplasia of the gingivae (Fig. 10) can be observed in a case of severe fibromatosis or elephantiasis gingivae as reported by Ball[3] and discussed by Orban.[4] This type

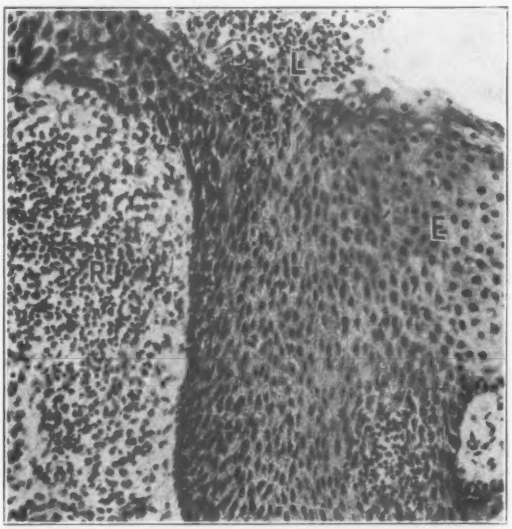

Fig. 2.—Higher magnification of area E Figure 1. R, round-cell infiltration; L, leukocytes which have escaped through epithelium (E) to surface. The epithelium shows no hornified layer upon the surface.

of hyperplasia might be called a borderline condition between a low-grade inflammation and a slowly developing tumor.

The epithelium in this lesion appears thin and atrophied in comparison to that seen in Figures 1 and 6. The surface of the epithelium is fairly well hornified and the presence of some keratohyalin can be seen in the superficial cells. However, the outstanding characteristic is the prominent projection of the proliferated connective tissue into the epithelium, leaving a thin layer of epithelium over the mushroom growths of connective tissue. There is evidence of a mild inflammation in the superficial connective tissue, with scattered masses of plasma cells and lymphocytes in the deeper layers. The connective tissue shows many well defined and enlarged fiber bundles, with only a few blood vessels present. The histologic picture is one of fibrous tissue hyperplasia, with an atrophied epithelial covering, in contrast to the more hyperplastic epithelium and less hyperplastic connective tissue seen in the gingival proliferations accompanying epilepsy treatment with dilantin sodium, and the cellular character of the common inflammatory hyperplasia.

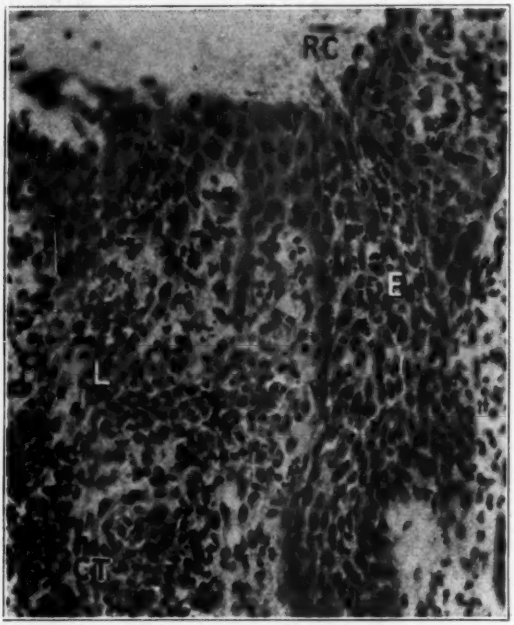

Fig. 3.—Area L of Figure 1 under higher magnification, showing acute inflammation with many leukocytes (L) in connective tissue. Some leukocytes appear in the epithelium, E. A small mass of red blood cells, RC, appear on the surface of the epithelium. CT, round-cell infiltration in deeper layers of connective tissue.

INFLAMMATORY HYPERTROPHIC GINGIVITIS

Inflammatory hypertrophy is most frequently observed in mouths that are not kept clean. The accumulation of soft deposits of dental calculus in the gingival crevices is the most common cause of irritation. With the accumulation of calculus, mouth organisms in-

crease. Fermentation and putrefaction of organic débris lower the resistance of the gingival tissues by maintaining an unhygienic condition of the oral cavity. Inflammatory cell infiltration results from irritation and the gingivae become swollen and edematous. This is followed by an increased exudate in the gingival crevices.

Mechanical irritants such as food packs, projecting margins of fillings, inlays and crowns or impinging removable appliances usually cause swelling and hypertrophy. When the gingival tissues seem to be more susceptible to local irritation than usual, a predisposing systemic factor may be suspected.

Irregularity in the alinement of teeth, especially of the incisors and cuspids, frequently interferes with the interdental papillae, pushing them from their normal interproximal relation. The subjection of such papillae to additional trauma from food or from the toothbrush keeps them in a continuous state of irritation. An excessive overbite of the upper incisors often causes food impingement upon the lingual gingivae of the upper incisors and upon the labial gingivae of the lower incisors, causing chronic inflammation and hypertrophy.

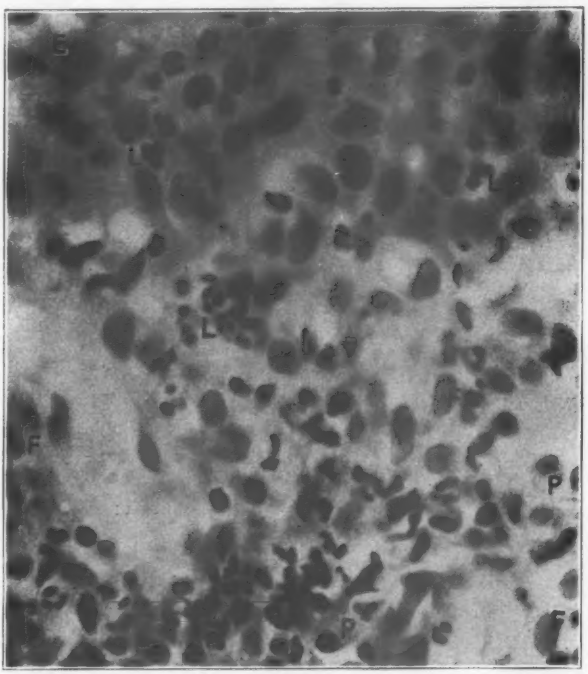

Fig. 4.—Higher magnification of area showing leukocytes (L), plasma cells (P) and fibroblasts (F), some of which show one or more nucleoli in cell nucleus. E, epithelium.

Mouth-breathing may be an important etiologic factor in hypertrophic gingivitis. In individuals who breathe by mouth, the labial gingivae are constantly subjected to the irritating effects of thermal changes, dust particles and other foreign substances. Dehydration has an irritating influence upon the abnormally exposed tissues in mouth-breathing.

While there are many mouth-breathers who do not suffer from hypertrophy of the gingivae, the number of mouth-breathers who do suffer from it is important. The irregularity of the teeth, indicating mouth-breathing, noted in many of the illustrations in the following pages, strongly suggests that this factor has some important bearing, primary or secondary, upon the etiology of the lesion.

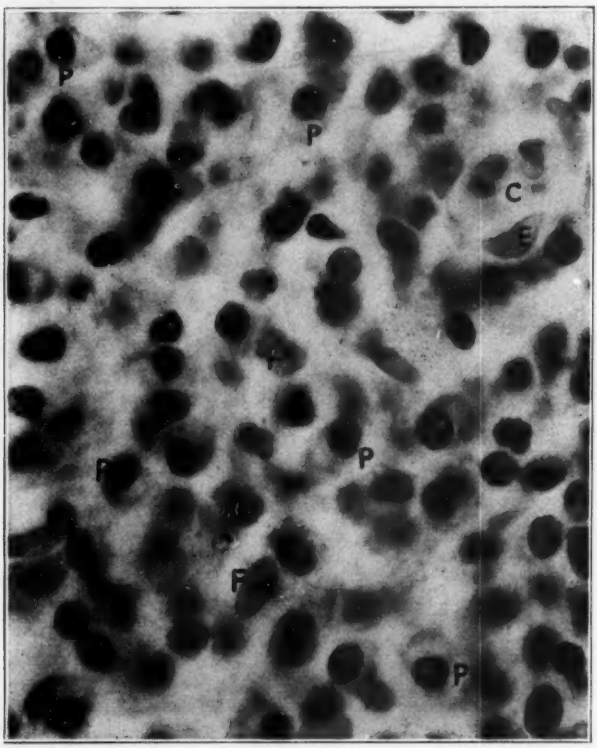

Fig. 5.—Higher magnification of another area showing mostly plasma cells (P), a characteristic of chronic inflammation; F, fibroblasts; C, capillary; E, endothelial cell.

PATHOLOGY

The septal gingivae are usually the first to show hyperplasia. They appear swollen and bulge out between the teeth on the buccal and labial surfaces. On the lingual surfaces, the papillae seem to be less susceptible to hyperplastic changes and often remain normal in size although the other surfaces are greatly enlarged. The swollen, hyperplastic tissue may increase in size until the crowns of the teeth become abnormally submerged by the gingivae. The presence of the protruding surfaces of the gingivae increases food retention and oral sepsis. As local irritation is continued, a state of chronic inflammation assumes a hemorrhagic or proliferative form. The protruding tissues become more susceptible to mechanical trauma of foods and of the toothbrush, which, as a rule, is not too generally used by persons subject

to these lesions. Many of the sufferers are adolescent youths or young adults who have never been taught proper methods of toothbrushing. The tissue may become highly inflamed, crimson red and hemorrhagic, or, in the more chronic conditions, it may remain quite normal in color although enlarged sev-

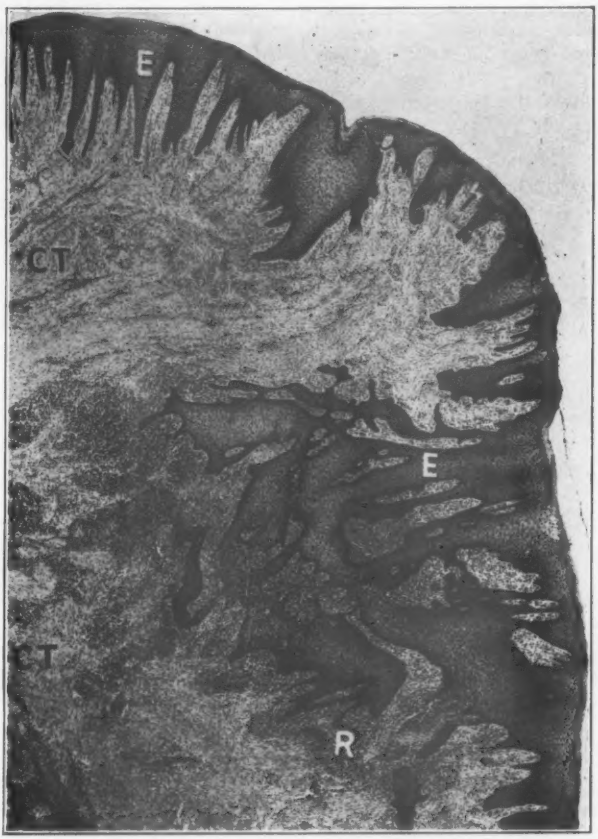

Fig. 6.—Hypertrophic gingival tissue resected from mouth of a boy of 14 years who had been on dilantin sodium therapy for about two years. E, epithelium with proliferations deep in connective tissue. (Compare Figure 1.) R, round-cell infiltration surrounding proliferated epithelium, showing chronic inflammation. CT, hypertrophic connective tissue moderately infiltrated with round cells throughout.

eral times, and the patient experiences little pain. In some instances, only the interdental papillae are hyperplastic and the growths bulge out until they appear to be pedunculated. Other manifestations not only include the septal tissue, but the entire gingivae of the teeth as well, which make thick collars around the necks of the teeth. The frequent absence of hyperplasia of the lingual surfaces of the gingivae may be due to the cleansing action of the tongue and the friction of food.

Inflammatory hypertrophic gingivitis

uncomplicated by other conditions is not difficult to diagnose. However, when the condition fails to disappear after local irritants are removed or corrected, it is quite obvious that there are other etiologic factors than local irritation, and further study of the case is indicated. Hirschfeld[5] states this fact as follows:

A gingival hypertrophy may be a symptom of a systemic condition which expresses itself at favored points of local irritation, or it may be caused primarily by local irritants which seem to be especially effective when a predisposing systemic factor is present.

If the gingival tissue always responded to irritation by hyperplasia, it would be very common indeed, but, in most persons, a considerable amount of local irritation will be tolerated by the gingivae before hyperplastic changes occur unless there is a particular susceptibility because of some systemic disturbance.

TREATMENT OF INFLAMMATORY HYPERTROPHIC GINGIVITIS

In treating hypertrophic gingivitis wherein local irritants are recognized, it is first necessary to establish as high a degree of mouth hygiene as possible. This is brought about by carefully but meticulously removing all dental calculus. Scalers and files should be carefully used to prevent injury to the swollen and edematous gingivae, although no harm results from gingival hemorrhage oc-

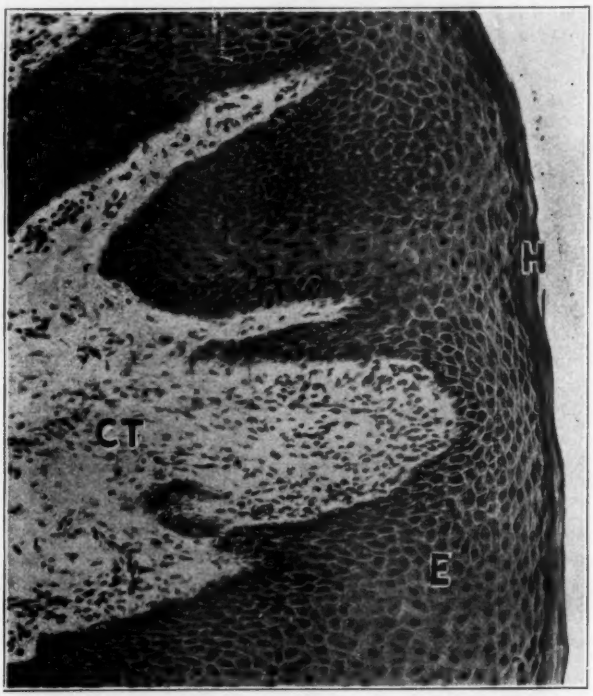

Fig. 7.—Higher magnification of epithelium from Figure 6. Very few inflammatory cells appear. H, hornified layer unusually thick and well developed; E, epithelial cells; CT, connective tissue.

curring without traumatization of the tissues. All irritating prostheses and appliances must be removed or so adjusted as to completely relieve the condition. Contacts that accumulate food must be corrected before the tissue can be restored to normal.

In subacute Vincent's infection or mixed chronic infections, treatment applicable to the type of infection should be instituted to bring it under control. This treatment is much the same as that indicated for acute Vincent's infection. The patient should be fully instructed in the Charters technic of toothbrushing and encouraged to maintain as high a degree of mouth hygiene as possible.

Where malocclusion and irregularity in the position of individual teeth, such as crowding and overlapping, seem to be either the primary or the secondary cause, it will frequently be found that the gingivae will respond favorably to a judicious use of strong astringents such as iodoglycerol (Talbot) in conjunction with adequate home care. In many cases, slight occlusal or incisal adjustment by spot grinding is beneficial. If

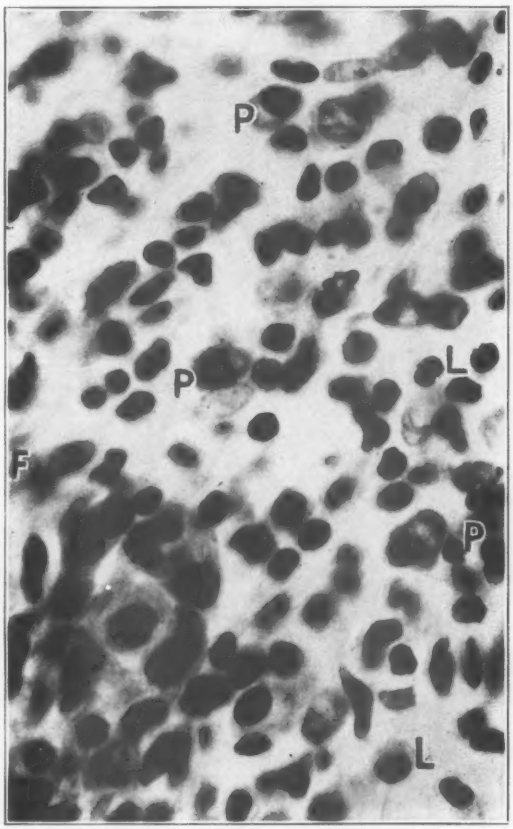

Fig. 8.—Higher magnification of area of Figure 6 showing plasma cells (P), lymphocytes (L) and fibroblasts (F).

the overbite is excessive and incisal impingement upon the maxilliary gingivae on the lingual or upon the mandibular gingivae on the labial aspect occurs, relief may be gained in some cases by shortening the incisal edges of the teeth. Correction should be made by orthodontic treatment when indicated, and bite opening may be undertaken in carefully selected cases.

states that a year and a half later, the gums were healthy, but the patient complained of losing her hair. It seems logical to believe that the occlusal adjustment was indicated, but a suspicion arises that the real predisposing cause remained although the gingival condition improved.

The judgment of the operator is often taxed heavily, and considerable resource-

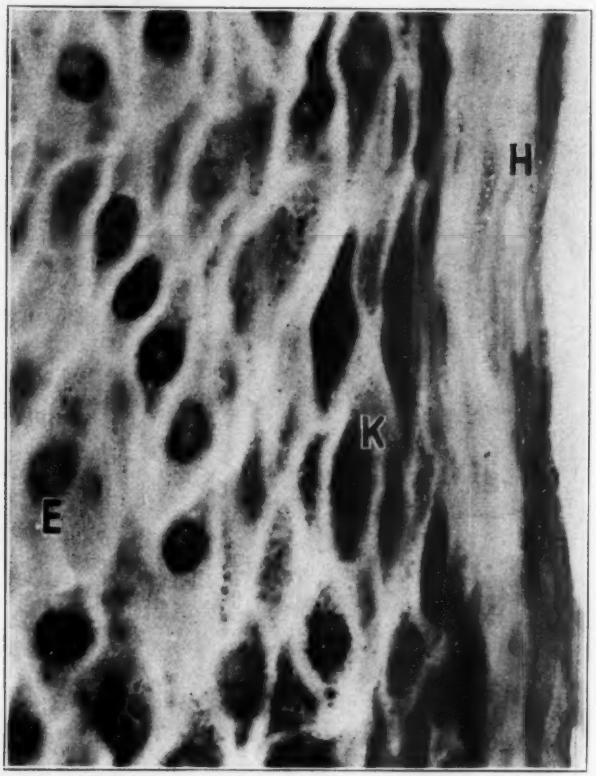

Fig. 9.—Still higher magnification of epithelium of Figure 7. H, very thick hornified surface layer; K, keratohyaline granules deposited in flattened cells of the superficial layers; E, prickle-cell layer of epithelium.

Hayden[6] reported a successful cure of hypertrophic gingivitis in an 18-year-old girl by adjustment of the occlusion. The lesion had recurred after gingival resection by another practitioner. He

fulness is required in both diagnosis and treatment. Local treatment and meticulous home care are essential to recovery in most cases of hypertrophic gingivitis, but local irritants may be only the ex-

citing cause and the lesion only a symptom of some imbalance or disturbance in the systemic functions which is intricate and difficult to control. However, a great many cases show complete cure with only prophylaxis and better home care.

HYPERTROPHIC GINGIVITIS ASSOCIATED WITH SOME SYSTEMIC DISTURBANCE

In describing the clinical manifestation of the systemic type of hypertrophic gingivitis, Thoma[7] names four subtypes that can be differentiated, namely, scorbutic, pregnancy, leukemic and diabetic gingivitis. Recently, Merritt and Putnam[8] have added a fifth subtype, which may be called a drug type. Only three of these conditions or types will be discussed at this time.

The Scorbutic Type.—Clinical symptoms of scurvy are more frequently observed than the actual disease. Usually, the symptoms of scurvy common to the gingivae are complicated by some local irritation while, in the edentulous mouth, the symptoms do not occur.[9] The gingivae become tender, swollen, edematous and turgid, with large bulging papillae that bleed on the least provocation. Gingival crevices are often filled with partly clotted blood from spontaneous bleeding. The crests of the interdental papillae become red or purple, with gradual ulceration and necrosis as

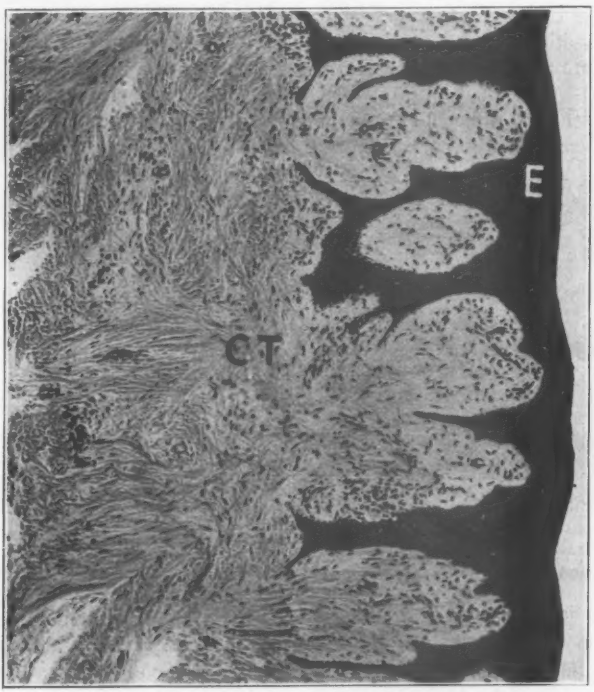

Fig. 10.—Fibrous hyperplastic tissue from case presented by Edward L. Ball, described as fibromatosis or elephantiasis gingivae. E, thin layer of epithelium. The proliferating connective tissue papillae (CT) push up into the epithelium. Fibrous hyperplasia of connective tissue exists throughout.

infection becomes superimposed upon existing susceptibility. In scurvy, other areas of the body are affected, and the diagnosis is usually determined on the basis of the condition present. It is not the typical form of scurvy that concerns the dentist, but the borderline cases that present a history of prolonged deficiency in vitamin-C intake. The borderline between health and disease from nutritional disturbances is not clear cut, and many times mouth symptoms resembling those of a definite scurvy type can be seen without the accompanying diagnostic symptoms in other parts of the body.

In a study of 100 adult patients to determine the concentration of cevitamic acid in the blood, Croft and Snorf[10] found that thirty-eight had vitamin C values below 0.40 mg. per hundred cubic centimeters of blood plasma. Some of these patients had values as low as 0.12 mg., and only 8 per cent of the thirty-eight had been on a diet adequate in vitamin C content. Of these thirty-eight patients, 64 per cent had dental caries, spongy gums or well-developed gingivitis. Other symptoms of scurvy, such as spontaneous petechiae or subcutaneous and submucous hemorrhage, were not found. Sixty-two patients of the group of 100 studied had average cevitamic acid values of 0.71 mg. per hundred cubic centimeters. Most of these patients had been on adequate vitamin C diets, and only 8 per cent of them were on a definitely low vitamin C diet. Of the sixty-two patients, 84 per cent had no caries or gingivitis, 6 per cent were edentulous and 10 per cent had dental caries and gingivitis. They used fifty healthy student nurses as a control group and found their blood plasma value of cevitamic acid ranged from 0.60 to 1.12 mg. per hundred cubic centimeters of plasma, with an average of 0.81 mg. per hundred cubic centimeters. In conclusion, they decided that since no signs of scurvy other than gingivitis and dental caries were detected in the deficiency group, although plasma values in cevitamic acid were as low as are found in scurvy, there might be some other factor than vitamin C deficiency in the etiology of scurvy. Gingival disturbances were common in the deficient group, but uncommon in the group with normal cevitamic acid blood plasma content.

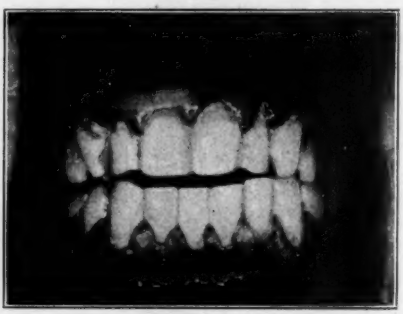

Fig. 11.—Inflammatory hypertrophy with subacute Vincent's infection. A section of this tissue would show many leukocytes, lymphocytes and plasma cells. A smear taken from the gingival crevices revealed a mixed infection with a predominance of Vincent's organisms.

The Pregnancy Type.—There is a form of hypertrophic gingivitis frequently observed in mouths of pregnant women. A very similar form is observed in many children during the adolescent period and in women during menstrual periods and is also said to have been found in men by Monash,[11] Merritt,[12] and Ziskin.[13] Ziskin states that it is due to some hormonal change going on at certain periods of life.

Gingival hypertrophy or proliferations are most likely to occur during the second or third month of pregnancy, according to Thoma.[14] It may affect the gingivae of a few teeth or may occur in all the gingivae. In a second type, there is a tendency for large proliferations to form in localized areas where protruding

pedunculated masses of hyperplastic tissue push out from the interdental papillae. This form of hypertrophic gingivitis was described by Blum[15] as the pregnancy tumor.

Birbaum and Fagnani[16] report that gingival congestion, hemorrhage and

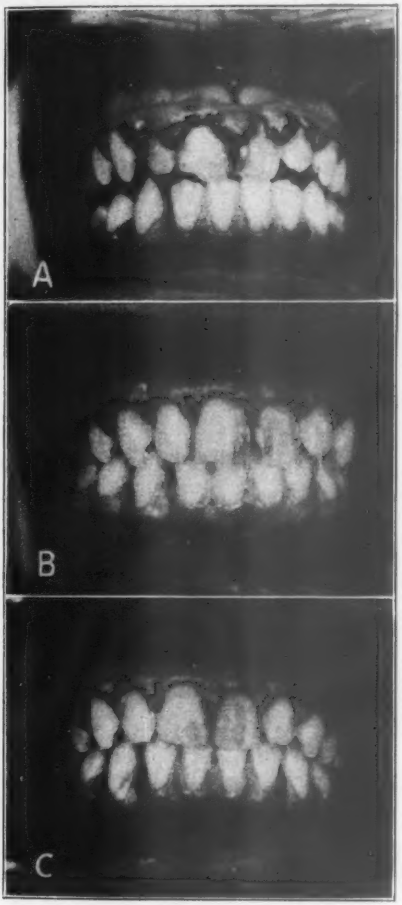

Fig. 12.—A, hypertrophic gingivae of girl aged 14. Only the labial tissue of the anterior teeth was affected. B, condition of gingivae six months after gingivectomy and treatment. C, condition of tissues one year later.

localized periodontitis are frequently caused by temporary hypertension during menstrual periods. This observation was made because of frequent postoperative hemorrhages that occurred during the menstrual period for which no other cause could be found than a predisposition at that period.

I have observed many girls and boys

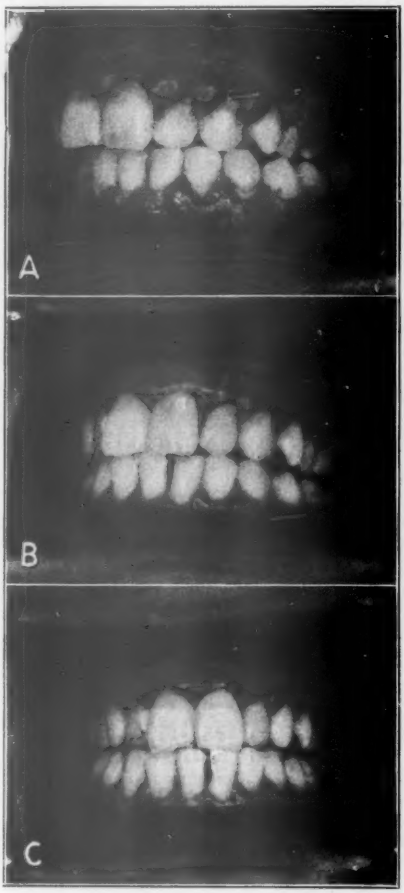

Fig. 13.—A, hypertrophied gingivae of girl aged 17. B and C, condition of gingivae after local conservative treatment without surgical aid.

in the dental clinic of the Chicago College of Dental Surgery, Dental Department of Loyola University, that have

hypertrophic gingivae both of the sessile and of the pedunculated type affecting the anterior gingivae mostly, but, in some instances, all but the molar interdental papillae. Photographs were taken before and after treatment of many of these patients, ranging in age from 12 to 22 years. This being the period of adolescence and early adult life when hormonal changes occur, there is justification for associating the abnormal gingival manifestation with a local irritation which by itself would not cause the lesion. The periods when severe physiologic changes occur are the adolescent, menstrual, pregnancy and the climacteric, when uterine involution occurs in women and prostatic involution occurs in man. These have been called periods of stress.

Fig. 14.—A, hypertrophic gingivae of boy aged 14. B, condition somewhat improved after local conservative treatment. With improved daily care, the tissue should gradually become normal.

Ziskin[17] has conducted investigations of the effect of hormonal treatment on the gums and oral mucosa of women. By experiments conducted on normal and castrated female rhesus monkeys, he was able to produce hyperplasia of the epithelium with a progressive loss of the keratin layer, a condition similar to the hypertrophic gingivitis of pregnancy, by injection of an extract from pregnancy urine. He also found degeneration of the gingival tissue in castrated and hypophysectomized rhesus monkeys.[18] These experiments verify the effect of hormonal disturbances as etiologic factors in the pregnancy type of gingivitis.

Fig. 15.—A, gingivae of girl aged 14, sister of boy in Figure 14. B, gingivae after conservative treatment and electrocoagulation.

The Drug Type.—A new type of hypertrophic gingivitis identified recently belongs to the group of conditions associated with systemic disturbances. In the treatment of epilepsy with sodium diphenyl hydantoinate (dilantin sodium),

which has been found to be a very effective remedy for the control of convulsions in this disease, a noticeable percentage of patients develop a marked hyperplasia of the gingivae. The drug is somewhat similar to the barbiturates, but is derived from glycolyl urea instead of malonyl urea. Kimball[19] reported a hyperplasia of the gingivae like scurvy (Fig. 18) in more than 60 per cent of those patients under treatment with sodium dilantin for a period of two months or more. He attributed the development of gingival hyperplasia to a lowered level of ascorbic acid and regarded the severity of the hyperplasia as parallel to the decrease in vitamin C in the blood. Frankel,[20] in a similar report, also associates the occurrence of hyperplasia with a decrease in the ascorbic acid content of the blood, although purpura, sore joints and weakness were not seen. Leech,[21] in his report for the Council on Chemistry of the American Medical Association, states that investigations on animals have not indicated any influence by the drug on the utilization of ascorbic acid. Fetterman[22] states that, at the New Jersey State Village for

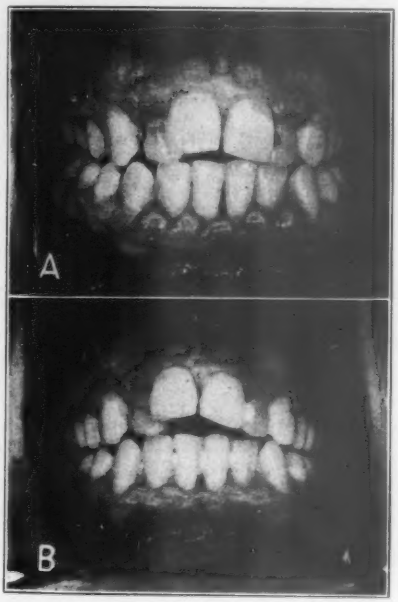

Fig. 16.—A, gingivae of girl aged 16. B, appearance after local conservative treatment.

Fig. 17.—A, recurrent hypertrophy of gingivae of girl aged 12. Three months before, the mandibular gingivae had been resected. B, condition nine months later, after conservative treatment. C, condition eighteen months after local conservative treatment. The entire personality of the girl had changed, from indifference to interest, with improvement of the personal appearance.

Epileptics, similar cases of hypertrophy of the gingivae were found in children, some of which spontaneously disappeared regardless of dilantin therapy.

PATHOLOGY

Hyperplasia that is due to the use of dilantin sodium does not seem to be confined to any particular age. The patients reported by Glickman and Lewitus[2] ranged from 15 to 42 years. The lesions are influenced in character by local irritation. In fairly clean mouths, the hyperplastic tissue is firm and smooth, is not particularly tender and does not bleed easily; but in mouths where the hygienic condition is poor, more inflammation and bleeding may be found. This is also true of other cases

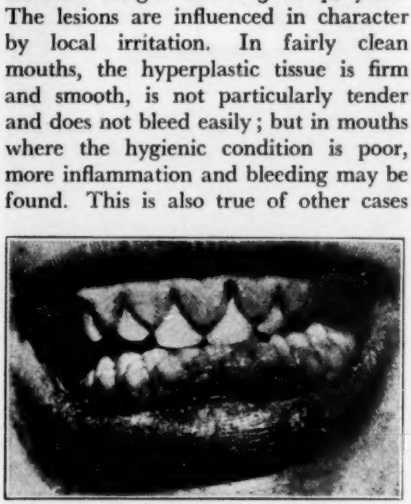

Fig. 18.—Advanced hyperplasia or hypertrophy of gingivae in a boy under treatment for epilepsy with dilantin sodium. (After Kimball.)

of gingival hyperplasia associated with systemic disturbances. The size of the proliferations may also be more or less influenced by the local conditions as well as by the amount and duration of the treatment. Glickman and Lewitus state that hyperplasia is frequently associated with tooth irregularity, and they believe that while these irregularities often fail of themselves to cause hyperplasia, they may encourage the development of it when the tendency exists. These authors did not find any evidence of hyperplasia in the tissue where a tooth was missing nor where missing teeth had been replaced by bridgework, and where a tooth that had been surrounded by a considerable amount of hyperplastic tissue was extracted, complete healing followed extraction, with no evidence of hyperplasia.

The case shown in Figure 19 had a history of recurrence after the resection of the gingivae while still relying upon dilantin sodium treatment for the control of convulsions. The proliferations appeared as enlargements of the interdental papillae, which overlapped the teeth on the labial surfaces until they almost touched each other in certain places. The lingual gingivae were only slightly hyperplastic. No particular pain was experienced from the hyperplasia

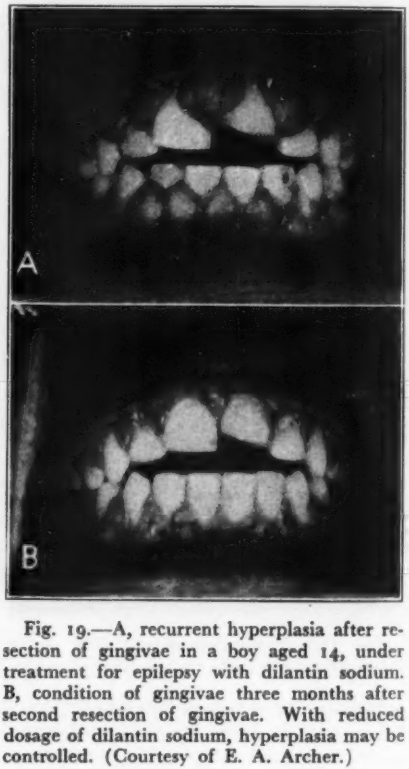

Fig. 19.—A, recurrent hyperplasia after resection of gingivae in a boy aged 14, under treatment for epilepsy with dilantin sodium. B, condition of gingivae three months after second resection of gingivae. With reduced dosage of dilantin sodium, hyperplasia may be controlled. (Courtesy of E. A. Archer.)

and there was no complaint of bleeding. The hygienic condition of the mouth was rather poor.

TREATMENT

The treatment of hypertrophic gingivitis, whether associated with systemic disturbances or not, consists in the correction and removal of all local irritation and the institution of strict oral hygiene. In those cases in which general treatment is indicated, the patient should be referred to the physician. The cooperation between dentist and physician is frequently necessary for the diagnosis and treatment of these conditions. Physicians also recognize the need for cooperation with dentists. Danforth,[23] an eminent obstetrician, writes that "every pregnant woman should have dental attention."

While hypertrophic gingivitis is not limited to any one general systemic disturbance, it seems to be most frequently associated with the disturbances that are observed during the years of adolescence and in menstrual periods and pregnancy.

Since hypertrophic gingivitis so frequently improves with local treatment, one might conclude that the local factors in its etiology are most important. However, the predisposing factors must be given much consideration. Early surgical treatment is contraindicated, because early elimination of a symptom such as the hyperplasia of the tissue does not permit of sufficient time for the operator to become thoroughly familiar with the case history and the characteristics and habits of the patient, and it is because of these things that recurrence of the hyperplasia following treatment is so frequent. The operator must gain the complete confidence of the patient and make continuous efforts to learn more about the patient in order to arouse his interest and desire to cooperate in every way. This is especially necessary in the treatment of adolescents, who are usually sensitive, shy and often indifferent in their habits and slow to cooperate in home care.

Where the history indicates a deficiency of vitamin C, a blood test may reveal a low ascorbic acid content. In most instances, this part of the diagnosis and treatment is in the field of general medicine. If the dentist suspects a deficiency and prescribes a larger intake of vitamin C, he may help to remove the predisposing cause of the lesion, but it is an empiric method of therapy when prescribed by guess. Since no harm can come to the patient from an increased intake of citrous fruits and tomato juice, it is usually logical for the dentist to recommend such foods, when the diet history indicates a probable deficiency in the intake.

In the treatment of typical pregnancy gingivitis, the removal of local irritants and the improvement in home care by the patient until after parturition usually is rewarded by a disappearance of the lesion. In those cases in which hyperplasia persists, surgical removal or electrocoagulation may be employed.

In the adolescent group, persistent hyperplastic tissue suggesting the pregnancy type of hypertrophic gingivitis may be removed by surgical methods or by electrocoagulation, but it is advisable to resort to such a procedure only after conservative treatment has been found unsuccessful.

Ziskin[13] has developed a method of treatment with female hormones which has not as yet become sufficiently standardized for common use. Endocrine and hormonal treatment should be guided by the physician, and cooperation between dentist and physician is indicated.

In the drug type of gingival hyperplasia, there is little to be gained from local treatment as long as the patient remains upon general treatment with

dilantin sodium. If the patient's tolerance for the drug can be established, its use may control the convulsions without causing gingival tissue disturbances. The spontaneous disappearance of the lesion observed when the patient was still on the treatment is a hopeful sign that eventually such a balance will be established.

SUMMARY

This study of hypertrophic gingivitis has been carried on for five years on patients appearing at the clinic of the dental college. The influence of local irritation appears to be an outstanding factor in the etiology of the condition and a cure is most frequently obtained by the removal of local irritants. The predisposing factors in each case are difficult to determine and control.

As long as the patient has a predisposition to hypertrophic gingivitis, local irritation should be prevented by prophylactic treatment and home care.

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HISTORY AND DEVELOPMENT OF PARTIAL DENTURE DESIGN

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FOR a complete consideration of partial denture design, it seems expedient to turn back the pages of history. We then have before us a panoramic view of the gradual development and recognition of the fundamental principles involved. In the early days, devices which seem to us intolerable were employed to restore function and appearance.

It is my purpose to describe the first application of each component part used in the design of a partial denture and, by making a comparison with present practice, to demonstrate the fundamental principles applied in any problem of design.

The first mention of a partial denture restoration is that of Heister, in 1711.[1] A block of bone or ivory was carved to fit the mouth, merely by measurement and constant fitting. This was no small achievement. Impression technic and the use of models was unknown.

In 1728, Pierre Fauchard, the father of modern dentistry, published the first scientific dental work.[2] He describes the construction of a partial restoration using a labial and lingual connector. Having made two blocks of ivory to occlude with a complete upper denture, and realizing that they would not function separately, he conceived the idea of a connector. (Fig. 1.)

Note that he used a labial as well as a lingual connector. Perhaps he had the acuity to recognize our first fundamental principle; i.e., "All connectors should be rigid and unyielding against a bending or torsional strain." His labial bar, and double riveting, helped to attain this ideal. Yet all of us have seen, and perhaps used, the wrought round wire lingual bar. (Fig. 2.)

Such an easily applied connector would have earned the condemnation of even Pierre Fauchard, particularly had he seen cast clasps attached to it. We must realize that all lateral and twisting movements of the saddles must be resisted by the connectors; otherwise, they are absorbed by the teeth, with serious damage.

We find no evidence of the use of palatal connectors until the description by Balkwill, in 1880.[3] Nothing further in this connection is noted until Southwell, at the Chicago Clinic in 1903, described several cases.[4] His technic involved the use of soldered pieces of metal upon a burnished base, which assured the desired stiffness. Yet today, many cast posterior or anterior connector bars are used alone. (Fig. 3.) As the cast horseshoe type cannot be made heavy enough to resist torsional strain, both posterior and anterior palatal bars should be combined to give maxillary restorations the proper rigidness.

In the early years, when only saddles and connectors were combined in these lower restorations, the lack of retention was sorely felt. Guerini gives credit to Mouton and Bourdet as the first to use a gold retentive clasp. They describe it in their publications of 1746[5] and 1757.[6]

Read before the Section on Partial Denture Prosthesis at the Eighty-Second Annual Meeting of the American Dental Association, Cleveland, Ohio, September 11, 1940.

Delabarre,[7] in 1817, refers to hooks and gives us a cut showing what is meant. This also shows the first known use of an occlusal rest. Prior to 1810, Emil Gardette,[8] of Philadelphia, described his use of the wrought band clasp. In 1847, Desirabode referred to round and half-round wire, as well as plate "whose bent extremities serve to fix to solid teeth." Doubtless the loose fit of these retentive devices saved many teeth from traumatic injury.

Grave concern was felt regarding the irritation noted around the abutment teeth. The clasps and the proximate saddle gouged into the gum margins of these teeth. Delabarre aptly describes this difficulty and suggests "little spurs,"

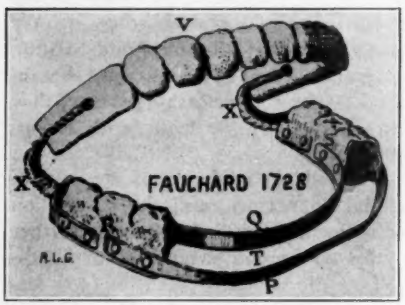

Fig. 1.—First known use of connector, by Pierre Fauchard, who endeavored to secure rigidity by use of labial connector as well as lingual bar.

in reality an occlusal rest, as a remedy. The appreciation of the value of the occlusal rest increased from 1817 to a climax in 1916, when James H. Prothero[9] advocated the placement of distolingual inlays in cuspids in which he placed a round bottomed groove. The occlusal rest functioned in this groove. Since Prothero specifically mentioned cuspids, it seems evident that he recognized the evil result of placing an occlusal rest on an inclined plane.

Bonwill, in 1893,[10] stated that the occlusal rest was an absolute necessity. Many formed part of their wide band clasps to rest upon the suprabulge of the tooth, and thereby secured an occlusal rest. The complaint was general that these band clasps destroyed the abutments in a short time through caries. F. E. Roach,[11] who had been constantly striving to improve these restorations, presented his "double-bow clasp," in 1913. While this was of the circumferential type and was made of wrought wire, it was a decided improvement over the wide wrought bands, and also the cast type that was rapidly gaining favor.

The first suggestion of the bar type clasp comes from Henrichsen, of Munich, in 1914.[12] (Fig. 4.) This was made of wrought wire, the terminal end of which

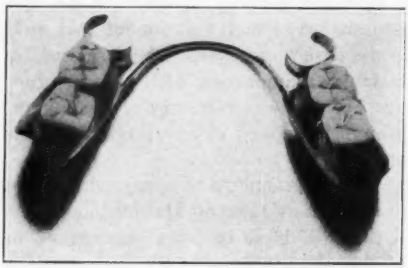

Fig. 2.—Well-known round wire lingual bar. It does not resist bending and twisting movements, thereby compelling abutment teeth to absorb these strains. Fauchard must have had round wire available, but he knew better than to use it.

was melted into a small ball. The wire was fixed to the saddle, crossed the tissues mesially and approached the bulge of the tooth in the typical modern infrabulge style. However, this idea seems to have escaped American notice, and not until Roach described his "bar type clasp,"[13] in 1930, did this outstanding improvement receive widespread recognition.

Another matter of historical interest was the development of the idea of balance, which, of course, was based on the use of the occlusal rest and a retentive clasp.

Balkwill's book,[3] 1880, page 83, says, ". . . it is evident that any tendency of the plate to drop must be either before or behind, in fact it will oscillate on this line." Finally, Prothero published an excellent cut, in 1916, in which he specifically called this balancing line the fulcrum line. The idea was greatly elaborated by W. E. Cummer,[14] who by this means developed a definite plan of indirect retention.

I propose to illustrate another line,

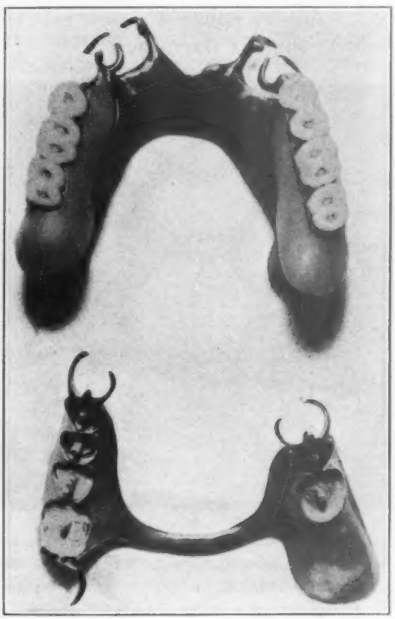

Fig. 3.—Commonly used single connector palatal bar, which permits too much twisting and should be reinforced by another connector to make the restoration rigid.

called a rotation line, on the mesiodistal axis of the saddle to demonstrate the buccolingual movement of the saddle on the mucosa and the occlusal rest seat. The only resistance offered to this movement is the stiffness of the connector, and if it fails in this respect, the force producing the movement will be transmitted into the tooth, in direct proportion as the clasping devices are able to operate as such. This now leads us to a consideration of all the factors involved as we understand them today. We should not be discouraged by the thought that it is mathematically possible to construct hundreds of thousands of restorations in the human mouth, each being different. A few fundamental principles clearly understood can be applied to any case, and every dentist should equip himself to render the service for which he is paid.

Let us now set down the different items, or factors, in their order of application in the development of design. Most of them have historical interest, but we shall consider them from today's point of view as follows: saddle, connector, occlusal rest, means of retention,

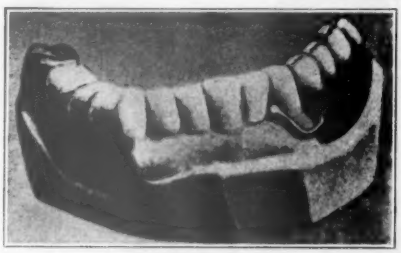

Fig. 4.—First suggestion of "bar type" or "infrabulge" clasp, made of wrought wire and melted into ball shape at terminal end.

reciprocal arm and stabilization, balance and movement and indirect retention.

SADDLE

The area and outline of the saddle is recorded upon a chart. Having made occluded study models, it is possible to determine the space available for the teeth to be supplied. The area of the saddle is usually to be as large as is permissible. The force and direction of occlusal movement, as well as the occluding teeth, will enter into the determination of outline. When occlusal force is brought upon the saddle, the tissues underneath will be displaced and movement of the saddle will result. This

movement is not in a single direction, but is variable. The saddle base may be flat or rounded. A flat ridge will permit greater buccolingual movement and a round ridge greater rotative movement, with its axis through the occlusal rest.

The saddles, to be most comfortable, should conform to the functional shape of the tissues, rather than the anatomic shape. This is assured by a special wax rebasing technic; which explains why we consider a combination metal-plastic case superior to the "all-metal" restoration.

CONNECTORS

Prevention of saddle movement in undesirable directions can be accomplished

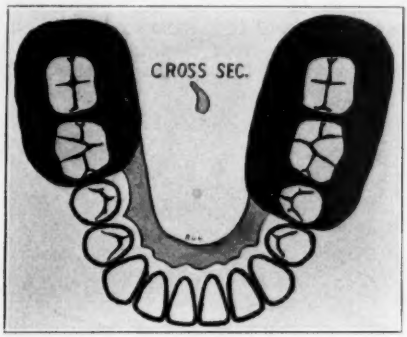

Fig. 5.—Lingual bar connector heavy enough and so shaped that it will resist bending movement and twisting strains.

by stabilization to the other side of the mouth; or a similar result can be obtained by connection with a saddle located elsewhere in the same arch. (Fig. 5.)

Saddle leverage upon its own abutment tooth may be tremendous, but, when transferred by a connecting lever to a distant point, it becomes slight. Who ever heard of a rubber crowbar? It may seem absurd, but many partial dentures are made with connectors that can easily be flexed or twisted. The old round wire lingual bar is an outstanding example. The single cast palatal bar is the worst offender today. Single maxillary palatal connectors cannot be made heavy enough for patient comfort to be used alone. Usually, two will suffice, but sometimes three connectors are necessary to give the required stability. (Fig. 6.) The posterior bar is placed just in advance of the point where the movement of muscular tissue begins in the palate. The second connector is best placed in the high part of the vault where the anterior aspect dips toward the teeth. If a third is used, principally to work out indirect retention, it may be threaded around between the high points of the rugae.

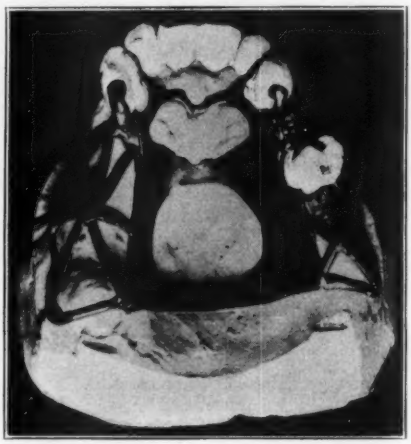

Fig. 6.—Third palatal connector, run between rugae to stiffen reciprocal arms as well as entire framework.

OCCLUSAL REST

The purpose of the occlusal rest is to transmit part of the saddle functional load to the abutment tooth and still, of even greater importance, maintain the clasp in the position where it will function best or to best advantage. Without a rest, the saddle would impinge upon the proximal gum tissue, and, with a bar type clasp attached to it, the bar would immediately traumatize the underlying tissue.

Were a wrought wire clasp used when

movement toward the tissue occurred, the terminal ends of the wire, being under tension against the tooth, would follow the undercut of the tooth and, remaining under tension, inhibit the free rise of the saddle. This interference with the freedom of saddle movement would eliminate stimulation to normal function and result in stagnation of the blood, irritation and rapid resorption.

Sometimes, the under side of the occlusal rest is ground for polishing. This slight reduction drops the terminal points of the cast clasp arm and reciprocal arm. The retentive terminal end loses its slight contact with the tooth, and the end of the reciprocal arm rides hard upon the suprabulge, this causing the appliance to spring slightly out of its normal seat when the functional load is released.

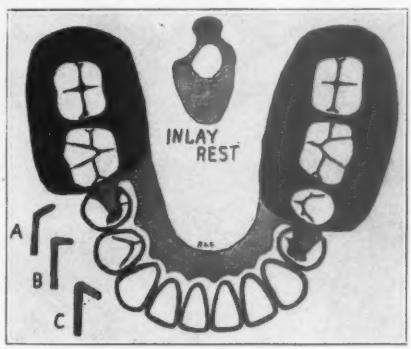

Fig. 7.—Occlusal rest rounded underneath and shaped somewhat like bottom of teaspoon. Its angle is never obtuse, as marked at A, as this produces an incline plane, which forces apart the tooth and the restoration. B is acceptable and C is an exaggeration of a slight reduction of a right angle, which assures the most desirable conditions.

Not only is it imperative to use an occlusal rest, but also, and equally, essential to preserve its original fit in its seat. Another effect of grinding and polishing the under surface of the occlusal rest, with a slight reduction of its designed position, may result in the occlusal rest arm riding hard upon the distal aspect of the marginal ridge, which is an inclined plane, and thereby forcing the case to spring slightly out of its placement position. Another error is failure to remove the sharp point within the angle between the rest and the rest arm. Its reproduction in the gold not only weakens the rest angle, but also prevents the ease of functional movement for which the rest seat was designed. This angle should be removed and rounded and the gold burnished rather than ground for polish.

The occlusal rest, being attached to the saddle, will move as the saddle moves. Now let us visualize the saddle as a lever, and the inside edge of the occlusal rest as the fulcrum point of that lever. In order to permit movement and some degree of rotation, the bottom of the rest must be rounded (Fig. 7), as exemplified in the shape of the bowl of a teaspoon. This shape will permit mesiodistal movement and some degree of buccolingual rotation.

Notwithstanding the rigidity of the connector against twisting strain, it is impossible to obviate all buccolingual movement, as well as rotation. If the occlusal rest were box shaped, or otherwise firmly held in place, the saddle and rest would transmit traumatic force into the tooth, as the tooth could not permit the connectors to absorb and disperse it.

Balanced occlusion is a vital factor in reducing the undesirable forces with which we contend. May I urge that you particularly study this problem, as its importance is even greater than in complete denture restorations.

The angle of the rest in relation to the rest arm is also important. (Fig. 7.) An obtuse angle should always be avoided. A right angle is desirable, but a slightly acute angle is best. This angle tends to lock the arm against the tooth. The effect of force upon an inclined plane is displacement of one or both opponents. The placement of an occlusal rest on the lingual aspect of a cuspid, which is an

inclined plane, is bad practice. Cutting into a sound tooth for an inlay with a carved rounded seat to receive the rest is fully justified.

MEANS OF RETENTION

Wrought plate and wire were the only means of retention for many years, until the advent of the casting technic. Then, with the ability to cast hard gold into rigid immovable arms securely attached to tissue-bearing saddles, the era of wholesale slaughter of abutment teeth began. Speeded by high pressure advertising, and supported by a laboratory net-

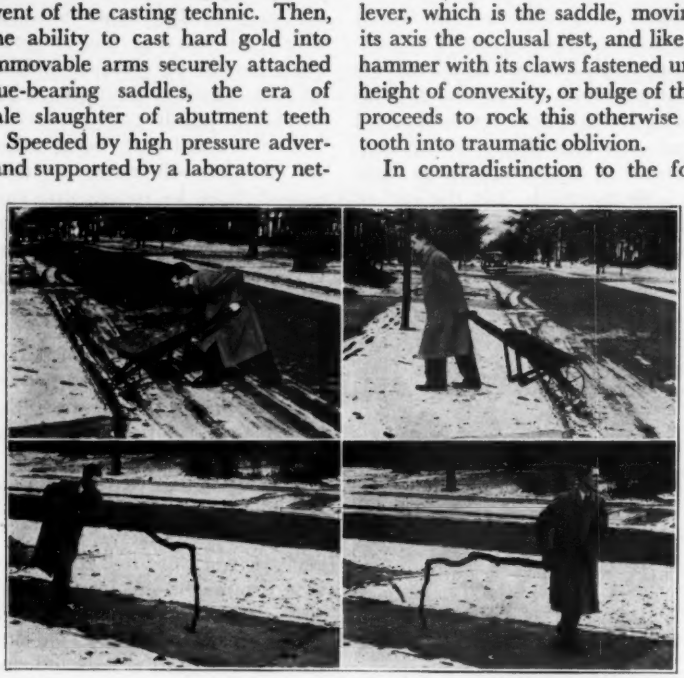

Fig. 8.—Illustration of pushing of diagonal clasp over bulge of tooth and, on other hand, pulling of "bar type" of infrabulge clasp over bulge into placement. The reverse movement makes it more difficult to displace a bar type clasp than a circumferential or diagonal type.

work of pseudospecialists, the profession was anesthetized into being a party to the largest cheap gold selling project the world had ever known.

Nearly all of these tooth-destroying devices were designed with circumferential or diagonal clasps, and with no regard for saddle movement, saddle fit or the subsequent ability to compensate for tissue changes.

When F. E. Roach presented his bar clasp technic, a star of hope was lighted on a very dismal horizon, and he has earned our heartfelt gratitude.

While wrought wire or plate secured a fair degree of retention, it certainly did not embrace the abutment tooth with an immovable grip such as that of the above-mentioned cast clasp.

The crow-bar action of the movable lever, which is the saddle, moving upon its axis the occlusal rest, and like a claw-hammer with its claws fastened under the height of convexity, or bulge of the tooth, proceeds to rock this otherwise healthy tooth into traumatic oblivion.

In contradistinction to the foregoing picture is a bar or infrabulge type of clasp. The base of the clasp arm is fastened to a point on the framework more distant from the axis or fulcrum point than exists with the base of a circumferential clasp arm. This fact, combined with the double or triple length of the arm, turned at a right or even an acute angle, tends to throw the terminal point of the arm into a slippage movement. These advantages, together with a flexibility many times that of a circum-

ferential type clasp, eliminate traumatic pressure.

Contrast this with the short rigid diagonal clasp, the retentive effectiveness of which is in direct ratio to its immobility, and the consequent necessity of resistance of the tooth to the movement of the saddle. Such a situation is not compatible with ordinary biologic conceptions.

Up to the present time, I have not mentioned the "survey." As it is outside the scope of this paper, I am assuming that it has been used. In our plan of design, we place the terminal point of the retentive clasp arm just below the bulge, the height of convexity or the survey line, as you may wish to call it. In case there is little bulge or undercut, it is advantageous to place the terminal end of the arm a greater distance below the survey line; but, usually, it is an error to place it at a greater distance, and the error becomes more serious as the incidence of the angle under the bulge increases.

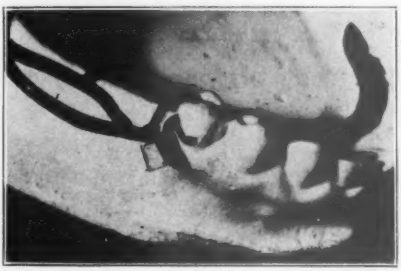

Fig. 9.—Insertion of thin piece of mica through wax and into casting model. The resulting fine split in the gold produces greater flexibility with a short arm.

Another argument against the suprabulge type of clasp is the fact that most of it rides on the suprabulge of the tooth, acting as another occlusal rest. This tends to prevent the normal functional movement of a correctly formed occlusal rest, and produces buccolingual trauma in the tooth. The danger from caries is vastly increased from the enamel coverage involved. In addition, this type clasp increases the area of the tooth offered to occlusion. This increase in occlusal area, combined with the incorrect tooth bulge presented to a bolus of food, increases trauma and results in improper food movement. The patient then enters an era in which only Nature's compensatory readjustments, and his complete ignorance of the truth, permit him to accept the inevitable and retain his respect for our service.

Another important consideration is the fact that a bar type clasp is easier to insert and harder to displace than the suprabulge types, which are exactly the reverse. Do we choose to push or to pull a wheelbarrow over the curb? With a curved branch of a tree in our hands, do we prefer to push or to drag it down the sidewalk? (Fig. 8.) We can imagine how the resiliency of the branch causes it to bite and jump every inch as we push it.

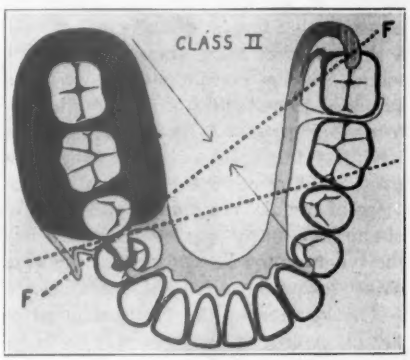

Fig. 10.—FF, fulcrum line. The other line is drawn to show the loss of indirect retention when the lingual bar and rest are terminated in the premolar region.

E. R. Stone[15] observed this phenomenon as applied to clasping teeth, and in his experiments demonstrated that a maximum of 143 per cent more power was required to push a clasp arm out of place than to pull it into place.

The angle of incidence of the clasp

arm is important to secure the foregoing effect, and the method of blocking out the undercut properly belongs to a discussion of "the survey."

Another matter of importance is a scheme to secure greater resiliency in a clasp arm when the bite is close and the arm too short. By directing the clasp arm mesially over the gum, and turning into an abrupt reverse hairpin turn for a short distance before proceeding across the undercut to the terminal point, considerable effective resilient length can be added to an otherwise stublike clasp. This presupposes an exceedingly fine split between the doubled arms, which can be obtained as follows. During the waxing operation, we cut into the investment model with a fine lance and place therein a thin piece of mica, then wax it to the model, leaving considerable excess mica extended to be held in the casting investment. (Fig. 9.) After casting, an exceedingly fine split will divide the arms from what appears to be a flat useless piece of metal. We must also be careful not to locate any part of the arm below the bulge or the line placed on the gum tissue during the surveying operation.

The location of the terminal point of the clasp arm is on the distal or distobuccal surface of the tooth. The reciprocal arm would be directly opposite on the mesiolingual surface. This point will be explained in the discussion of movement and balance.

RECIPROCAL OR STABILIZING ARM

When the term reciprocal is used and this arm is visualized directly opposite the terminal end of the retentive arm, a confused idea of its purpose may result, the error being that it is constantly resisting pressure from the retentive arm and thereby protecting the tooth. This involves a misconception of the action of the retentive arm. In the position of placement, the retentive arm should touch, but not press upon, the tooth, and it never should be adjusted with pliers to exert pressure upon the tooth when the case is at rest.

When an effort is made to dislodge the case, the retentive arm starts to resist the movement as it is under the bulge of the tooth. At the same moment, the reciprocal arm is lifted off its seat and, being on the suprabulge, loses its seating and does not resist the retentive arm at all. In other words, the terminal of the reciprocal arm is placed on and above the survey line in such a manner as to resist any possible pressure. The undercut, if any, is completely blocked out to attain this result. The arm is usually short and heavy and, having no resiliency, it then stoutly transmits and helps dissipate the strains and stresses coming through the

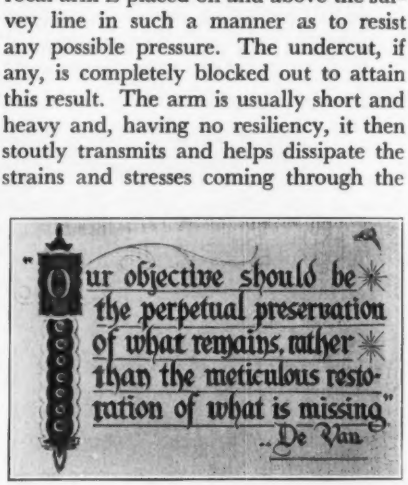
"Our objective should be the perpetual preservation of what remains, rather than the meticulous restoration of what is missing"
-De Van

Fig. 11.—Scroll emphasizing to patient importance of mouth hygiene.

connector from its own saddle, and particularly the one from the opposite side. As the reciprocal arm is placed on the mesiolingual aspect of the abutment tooth, the tendency in "tissue-directional" saddle movement would be to drive the terminal end of this arm into the tooth if it were caught under the tooth bulge. This traumatic pressure is evaded by permitting the end to slide on or be lifted from an inclined plane or the curved suprabulge surface. This movement somewhat harmonizes with the arc of movement of the arm tip, as related to the axis, of which the rotation point is the marginal ridge under the occlusal rest.

Without the reciprocal arm, bucco-

lingual saddle movement would tend to dislodge the occlusal rest and throw the retentive arm out of position. Stabilization is in reality a most important function of the reciprocal arm.

BALANCE AND MOVEMENT

To understand balance, an axis or fulcrum line must be visualized. When no movement is evident, balance prevails. Movement successfully prevented by counter resistance will be considered suitable balance for our purposes. The balancing lever must have a fulcrum point, to which it must be fastened to prevent being completely lifted off its seat by applied forces. It is recommended that we use a tooth chart, blocking out all missing teeth. Two abutment teeth are located on opposite sides of the mouth which will accept retention and an occlusal rest. A fulcrum line is drawn through the marginal ridge of each occlusal rest. (Fig. 10.) An effort is made to obtain an equal extension of the restoration on each side of the fulcrum line. This, of course, is usually not possible.

The movement of the saddle in displacing tissue or when pulled away from it by sticky food and, in maxillary restorations, by gravity, is visualized. We expect and provide for saddle movement toward the underlying tissue, but we aim to prevent the opposite movement by indirect retention or resistance on the opposite side of the fulcrum line and as far from it as possible to enjoy all the advantages of leverage.

When a saddle is pressed directly toward the tissue, its rotative point is the marginal ridge under the occlusal rest. When some force attempts to lift it away from the tissue, the rotation point is somewhere under the occlusal rest. Hence, it is imperative that the rest be rounded, to permit slippage, which helps the retentive clasp terminal to better hold its position.

If the tissue ridge is flat, we do not have the ridge to help resist buccolingual displacement during mastication. The amount of strain thrown into the abutment tooth through the retentive and reciprocal arms will be dependent on the stiffness of the connector. We should aim to dissipate this force by a rigid connector, stabilized on the opposite side of the mouth.

If balance in occlusion may not prevail, perhaps efforts at safety in lower cusp teeth would be the better judgment. When the ridge is rounded, a buccolingual rotation is evident. Again, the rounded occlusal rest permits the framework to accept the strain. In depressing the saddle toward the tissue, the arc of movement is such that the tip of the retentive clasp is thrown away from the tooth, and the tip of the reciprocal arm slides on or rises from the suprabulge of the tooth. This is another reason for locating these clasps as suggested. To save the remaining teeth from traumatic forces should be the chief aim in design.

INDIRECT RETENTION

After a study of movement on each side of the fulcrum line, the purpose of indirect retention is self-evident. We provide for, and accept, movement of the saddle in the direction of tissue displacement, but, by means of the above-described device, we immediately stop movement in the opposite direction. We strive to locate this position as far away from the fulcrum line as possible, so as to gain the advantage of leverage. The inclined plane of the lingual surface of an individual anterior tooth is a dangerous location. Where it is necessary to use anterior teeth, a secondary lingual bar behind them all, and with a prepared seat, offers the most effective solution. Since the effectiveness of an indirect retainer depends upon a definite seating, its location upon an occlusal surface, such as the mesial pit of the first premolar, is highly desirable.

Many complaints that the lingual bar in a mandibular restoration cuts the tissue result from the lack of indirect retention rather than the close fit of the bar. The jumping of the saddles away from the tissue forces the inner side of the lingual bar against its underlying tissue. Indirect retention stops this undesirable movement.

As I have not cited a specific reference[16] to an unpublished thesis written by Oliver C. Applegate titled "The Partial Denture: Its Origin and Development," I wish at this time to express my indebtedness for the historical references found therein. It is exceedingly unfortunate that such a valuable and outstanding piece of work has remained unpublished.

The problems met in design have ceased to be strictly mechanical and are subordinated to the biologic. The biologic concept of the effect of pressure and movement on living tissue, and the ability of the tissue to accept it, should motivate and direct every application we make of mechanical principles.

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THE IMPACTED MANDIBULAR THIRD MOLAR

By Fred G. Repass, D.D.S., M.S.D., Roanoke, Va.

A TOOTH is spoken of as being impacted when its eruption is partially or completely obstructed by some other tooth or a tooth root, or by dense bone.

In reviewing the literature for the causes of impaction, one would almost be compelled to conclude that nearly every one would have impacted teeth. The etiology covers virtually every fantastic idea that has been brought out in both medicine and dentistry. It is believed that impaction is the result of endocrine imbalance,[1] malposition of the tooth germ[2] in its development, acute infectious fevers of childhood, inflammation of the jaws, brought about by caries, traumatic injury of the mandible in early life, mouth-breathing or faulty orthodontic treatment, and even diet and vitamins are mentioned.

Opinion differs quite widely in regard to the indications for removing impacted and unerupted teeth. I shall briefly consider a few important principles upon which our decisions in practice should be based.

In most cases, if the third molar has partially erupted and there is a flap of gum tissue over the crown, a very unclean condition will exist. (Fig. 1). The presence of these areas is very conductive to the rapid growth and reproduction of micro-organisms, which, if the tooth does not erupt, result in repeated attacks of pericoronitis or acute inflammation of the soft tissue surrounding the crown. It appears that each succeeding attack is more severe. I have seen grave disturbances and envolvement of deeper parts of the throat and neck during an attack of pericoronitis.

It is usually at this time that the patient consults a dentist for relief, and insists that the tooth be removed. However, under no circumstances should the tooth be removed during this stage of acute inflammation and swelling. Extraction should be delayed until after the acute condition has subsided or has been brought under control by irrigation and antiseptic treatment and the virulence of the invading organisms has been reduced. This course may run from a few days to possibly ten days, but it will avoid grave complications that may follow if an operation is performed in the presence of active acute infection.

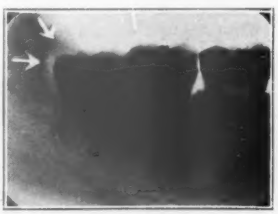

Fig. 1.—Chronic infection about crown of third molar following repeated attacks of pericoronitis.

To treat this acute condition, the operator should irrigate the area daily with a hot physiologic solution of sodium chloride, and if a flap of tissue partly covers the crown, he should irrigate with, and work under the flap of gum tissue, some mild antiseptic solution, such as tincture of metaphen 1:200 or mercurochrome. The patient should be instructed to use hydrogen peroxide

Read at the twenty-fifth annual meeting of the Piedmont Dental Society, Danville, Va., October 15, 1940.

and hot water, equal parts, every hour or half hour, as, in most cases, Vincent's infection is present. Some pain-relieving agent should be prescribed (such as phenacetin and acetyl salicylic acid 5 grains each whenever necessary). The lancing or removal of the gum tissue covering the crown at this time, as is the practice of many dentists, is strongly condemned.

There has been some controversy concerning the impacted or unerupted tooth as a possible source of focal infection. It is generally conceded that any impacted tooth that has an opening to the surface or has a partially exposed crown usually is a potential focus of infection. Lucas[3] and Wahl[4] state that impacted or completely embedded teeth may harbor virulent micro-organisms and be infected. They are of the opinion that after the enamel organ has finished its function and the tooth does not erupt, the remnant of the enamel organ, or Nasmyth's membrane, becomes physiologically and embryologically a functionless tissue, acting as a chronic irritant to surrounding tissues, with a localized inflammation resulting. In this area of inflammation and lowered tissue resistance, micro-organisms become localized from the blood stream and the tissues, of course, become chronically infected.

Many perfectly sound second molars have been damaged or lost by decay or by resorption of the crown or root in third molar impactions (Fig. 2). The dentist knows what may take place, but often advises the patient not to have anything done about the impaction until it causes trouble. The impacted third molar is a "snake in the grass."

It is very unwise to place dentures over unerupted or impacted teeth.

Rapidly forming cysts (Fig. 3) and odontomas (Fig. 4) are often found about impacted or unerupted teeth; another indication for early removal.

Much has been written concerning the effects of reflex disturbances due to pressure of the impacted tooth on nerves and other structures (Fig. 5). L. R. Main, of St. Louis, has recently studied widely certain disturbances that may be brought about by pressure reflected by way of the autonomic nervous system. Main[5] says:

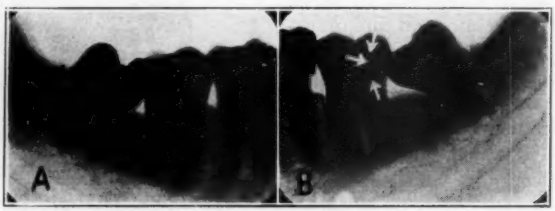

Fig. 2.—Decay of right and left second molar teeth due to impaction of third molars.

Impingement on the mandibular canal by a third molar occasionally becomes a factor in reflex complications. In fact, this condition is responsible for more reflex disturbances than any other dental finding. . . . Occasionally, gastric disturbances are the result of a mandibular third molar pressing on or somehow interfering with the mandibular canal and nerve. Hence, we suspect that impulses are conveyed through the vagus or tenth cranial nerve, which is both a sensory and a motor supply to the stomach. . . . Impactions of any sort or supernumeraries should be viewed with suspicion. . . . The maxillary third molar may and sometimes does become a seat of referred pain. Sometimes, we endeavor to ascribe all disease to some focus of infection. Therefore, when we make a complete radiographic ex-

amination of the teeth and find no infection, we frequently consider the teeth as negative factors, even though there are one or more impactions in the case. Experience in dealing with teeth when definite pressure on certain structures can be demonstrated radiographically indicates that undue pressure can and does give rise to general disturbances, and infection may not enter into the case at all.

Fahy,[6] in 1926, said that 75 per cent of orthodontists believe that the erupting third molar not only can but does have an effect on the adjacent second molar as well as on the other teeth in the arch. Five years later, Davis[7] was of the opinion that 100 per cent of orthodontists recognize the fact that not only the erupting third molars, but also the malposed third molars that never will erupt have a definite action on the other teeth in the mouth. He concludes that impacted teeth should, by all means, be removed, if at all, while the patient is young and in good health. More recently, Ford[8] states that an orthodontic case cannot be dismissed as completed until the third molars have erupted into normal position or have been extracted.

Fig. 3.—Dentigerous cyst about impacted third molar.

An impaction should never be thought of as an emergency, and operative procedure hurriedly begun before thorough study of each case. First of all, a detailed roentgenographic examination should be made. I have found that, as far as exactness of detail for operative studies is concerned, the average dentist fails to make as perfect roentgenograms as he should. From a correct roentgenogram study, the operator should be able to obtain the following information: the relation of the tooth to the long axis of the second molar; the relation of the tooth to the ramus of the mandible; the deflection of the crown buccally or lingually; the depth of the crown in bone; the density of the surrounding bone; the curvature or formation of the roots, whether hypercementosed or fused, and its relation to the mandibular canal; the pathologic condition present about the crown, and the condition of the second molar.

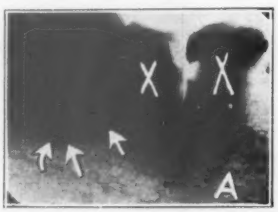

Fig. 4.—Odontoma about partially erupted third molar.

Fig. 5.—Fading away of roots at point of contact with mandibular canal, indicating impingement. (Main.)

A thorough clinical study should be made, including the mental attitude of the patient, the condition of the surrounding tissues, the accessibility for operative procedures, as the size of the oral cavity and tongue and the extent that the patient can open the mouth, and the age and health of the patient.

From the roentgenographic study, we can classify the impaction. I use the

classification that has been worked out by Pell[9] and Winter.[10]

I employ premedication in all cases before the removal of impacted teeth, using one of the accepted barbiturates. I find that this overcomes nervousness and fear of the impending operation and renders the patient quiet and much more cooperative. Also, it tends to counteract the toxic effects of the procaine used.

The anesthetic of choice is the one that will serve the patient best. For the more difficult impactions, I prefer a local anesthetic.

The technics for the removal of impacted teeth are many. The trend now seems to be toward a method which conserves bone, saves operative time and causes less trauma, thus eliminating postoperative discomfort and complications. This is in opposition to the method of the operator who prides himself on removing the impacted mandibular third molar in its entirety. As Miller, of Chicago, recently stated: "The tooth belongs to me, but the bone belongs to the patient." Thoma[11] has said: "It is better to injure the tooth to be removed than to cut away a great deal of the tissue that later has to be replaced by repair." The method that I use is one in which the minimum amount of bone is cut away, and the tooth sectioned and each portion removed separately. The technic has been ably described in detail by Field and Ackerman.[12]

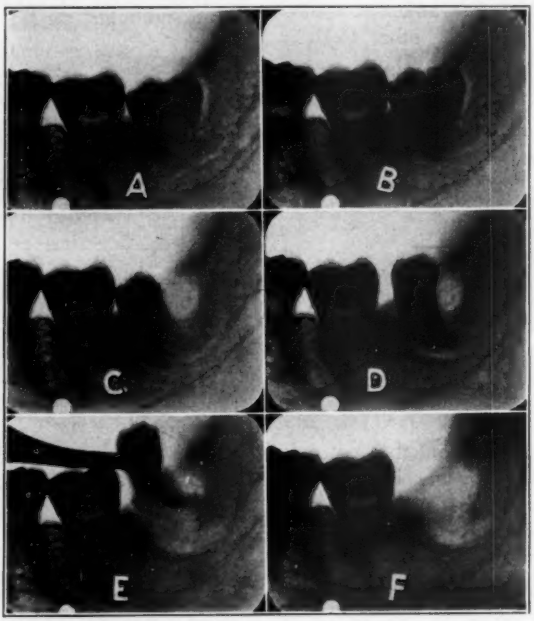

Fig. 6.—Vertical impaction. A, preoperative view. B, distal part of crown split off through buccal groove. C, distal part of crown removed. D, tooth elevated backward and slightly upward. E, tooth being removed from socket by buccal application of Potts' elevator. F, postoperative roentgenogram.

Assuming that the proper anesthetic has been selected and administered, an incision is made distally from the second molar over the occlusal aspect of the

impacted molar nearer to the lingual than the buccal aspect, extending for about 1 inch or more upward on the ascending ramus of the mandible. Another incision is made starting at about the middle or buccal groove of the second molar, continuing obliquely downward one-half inch or more and terminating in the buccal reflection of the mucous membrane about in line with the mesial surface of the second molar. With proper periosteal elevators, the mucoperiosteum is gently retracted and the bone or crown of the third molar exposed. Excision of the bone, if necessary, is accomplished by the use of a motor-driven chisel or bibevel drill.

In case of a vertical impaction with both roots curved distally (Fig. 6), a sharp bibevel chisel is placed in the buccal groove, directed downward in line with the long axis of the third molar,

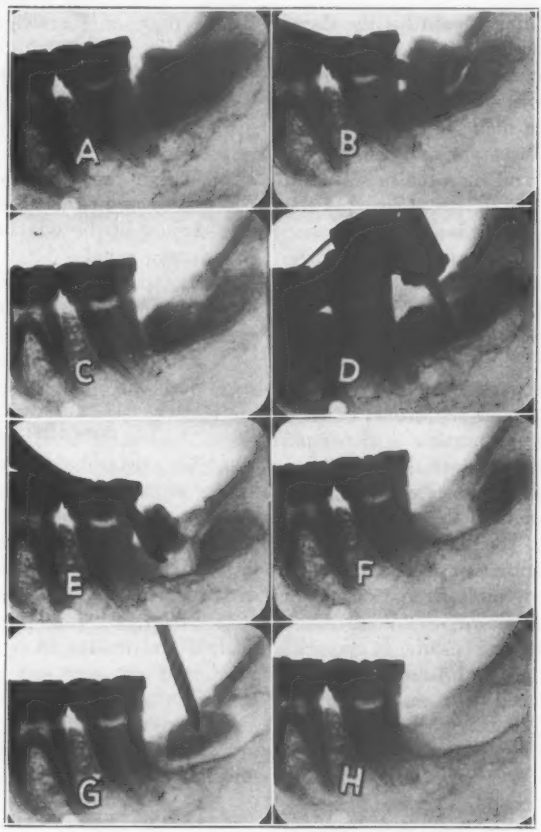

Fig. 7.—Horizontal impaction. A, preoperative roentgenogram. B, distal or uppermost part of crown split off; chisel in buccal groove. C, distal or uppermost part of crown removed. D, remainder of crown severed through pulp chamber with bur. E, remainder of crown removed with Potts' elevator. F, crown removed. G, root portion brought forward into space previously occupied by crown. H, postoperative view.

and, with the aid of one or two blows of the motor-driven mallet, the distal portion of the crown is split off. With elevators, the distal part of the crown is removed, this permitting the remainder of the crown to be displaced distally and upward out of the socket, by mesiobuccal and buccal application, respectively, with elevators.

A similar technic is used for the distoangular and mesioangular types of impactions. However, in the mesioangular type, if the roots are bifurcated, an attempt should be made to split the tooth through the bifurcation and remove the distal half first and then the mesial half.

In the horizontal type (Fig. 7), the chisel is placed in the buccal groove and the distal or uppermost portion of the crown is split off and removed. With a cross-cut fissure bur in a contra-angle handpiece, the mesial portion of the crown is severed through the pulp chamber. This mesial part of the crown is then easily removed. With the crown entirely removed, the root portion is dislodged and brought forward into the space previously occupied by the crown and lifted out, this completing the removal.

Postoperative roentgenograms should immediately be made of the case, all débris removed and sharp edges of process smoothed down.

Usually, only one suture is required to close the wound. I use No. 6 black silk suture, placed just distally to the second molar. A small piece of iodoform gauze is placed lightly in the wound back of the suture. The patient is instructed to apply an icecap immediately to the jaw, leaving it on for thirty minutes and off for fifteen minutes for the next five hours, after which a warm saline mouthwash is used every hour (one-half teaspoonful of salt to a half-pint, or a large glass, of warm water). A prescription, usually composed of phenacetin, acetyl salicylic acid and codeine phosphate, is given to relieve pain.

In twenty-four hours, the dressing is removed and the wound gently irrigated with a sterile physiologic sodium chloride solution. This should be carried out for several days. If there is no organization of a blood clot, the wound will have to be treated as a "dry socket." The pain is controlled by the application of iodoform gauze saturated with eugenol, the dressing being changed every twenty-four or forty-eight hours until granulation tissue begins to form.

The disadvantages to this technic are:

1. The difficulty of removing root tips after splitting.
2. The possibility of fracturing the lingual plate and pushing the tooth into the soft tissue of the floor of the mouth.
3. Injury of the vital structures of the mandibular canal.
4. The possibility of fragments of the crown becoming lost in the throat, soft tissue or socket.
5. The need of considerable experience and skill in mastering the technic.

CONCLUSIONS

1. The mandibular third molar is a factor in local and systemic disturbances.
2. A thorough clinical and roentgenographic examination should be made in each individual case before operation is attempted.
3. Preoperative and postoperative medication and treatment are imperative for the best results.
4. The sectional technic with the motor-driven chisel saves time and minimizes postoperative discomfort and complications.

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PITS AND FISSURES IN THE PERMANENT TEETH: THEIR TREATMENT

By THOMAS A. GARDNER, Omaha, Nebr.

TO some, it may appear an imposition to bring the apparently academic subject of pits and fissures in the permanent teeth to the attention. However, in my experience, it has been found exceedingly difficult to convince members of the profession, both graduates and undergraduates and, at times, even members of dental faculties, of the importance of filling pit and fissure cavities. It is my belief that these are the most neglected of all the cavities that come to the dentist from the consideration of both diagnosis and operative dentistry. Perhaps they do not appeal to the creative or inventive type. Casually, they may not offer the same mental, spiritual or economic challenge that would come from dealing with a complicated bridge or partial denture. But for those who have studied this problem for many years, it can be said that there is no greater challenge to the dental profession in the realm of preventive dentistry than that of diagnosis and filling of pit and fissure cavities. This paper will deal with the subject exclusively as applied to the child patient. However, the material presented will be found to be almost as applicable to the adult patient.

Read before the Section on Children's Dentistry and Oral Hygiene at the Eighty-Second Annual Meeting of the American Dental Association, Cleveland, Ohio, September 11, 1940.

The general practitioner, having viewed the havoc wrought upon the mouths and health of the adult patient, should endeavor to seek every means to guide the child patient along the path of prevention. The filling of pits and fissures in young teeth is not a panacea for all dental ills, but it is one of the phases of preventive dentistry which is often neglected. The careful filling of these defects will materially aid in improving the health of the future adult patient.

Two reasons are offered for the presentation of this paper: 1. The profession's failure to universally recognize and accept the classification of pits and fissures as true cavities. 2. The need for addressing a plea to the profession to perform the highest possible type of operative dentistry in Class I cavities.

Let us attempt to analyze the causes of failure to deal with this problem:

1. The fault may lie with the dental colleges in their failure to teach this type of preventive dentistry.

2. Many dentists believe that, by frequent checking, these defects may be

filled when the decay has broken down a sufficient amount of enamel to permit the detection of positive decay. In other words, they believe, conscientiously, in "watchful waiting." Because of the nature of pit and fissure decay, this policy has doubtful merit. For example, most dentists have discovered all too frequently that, with little breaking away of the enamel, the entire crown of the tooth may be involved by the carious process. By following the theory of "watchful waiting," most of such extensively involved teeth can be saved from the necessity of actual extraction, but at a sacrifice of the health of both the tooth structure and the pulp of such teeth. However, in order to accomplish this, every one of our patients would have to return for inspection every few months, without fail. How many dentists get their patients to return with such regularity? Yet we are depending on filling these teeth at just the right time. The attitude is probably a large factor in the gross injury or loss of millions of teeth annually. Let us adopt some such slogan as "Fill it while it is still a defect."

3. Faulty diagnosis or improper examination of the teeth undoubtedly results in failure to discover pits and fissures that should be filled. A suggested procedure for diagnosis will be given later.

4. The dentist fails to observe and correlate the vast amount of evidence which passes daily before his eyes—an endless parade of evidence, consisting of large and small occlusal fillings, teeth with crowns partially or wholly destroyed and the many teeth in need of extraction, all involved because of pit and fissure caries. Should it be so difficult to deduce that these conditions are attributable to pit and fissure defects?

5. Fear may be a barrier to the filling of these defects. There is a type of dentist who hesitates to inform the patient of the actual condition of his mouth because he is afraid to do so. He thinks that the patient will feel that he is recommending fillings or other work that is not necessary. Surely, it is our professional responsibility to report all findings to the patient, passing the responsibility on to him in the event that the work is not done. The presentation of all facts should not cast reflections upon the dentist. It has been my experience that when parents are taught the story of pit and fissure caries, 99 per cent of them are anxious to have defects cared for. They seem to quickly grasp the thought, "Well, that must have been what happened to my teeth." The dentist who withholds the facts because he is afraid of losing his patients will certainly lose them anyway, as soon as they realize that he has not given them the type of service that they sought.

The profession can perform the highest possible type of operative dentistry in Class I cavities by observing the following routine:

1. A careful and thorough examination of all Class I areas.

2. The use of a rubber dam whenever possible (at times, very difficult with the child patient).

3. A better cavity preparation, with special attention to extending fissures to immune areas.

4. The proper sterilization of cavities.

5. The use of the proper filling material, together with the best of technical manipulation.

EXAMINATION

A thorough examination requires that certain instruments be used: a mouth mirror in good condition, magnifying if desired; a sharp explorer (carbon steel piano wire with finest possible points); an air syringe (air pressure is best); binocular loupes; a diagnostic lamp, and x-rays.

If the teeth and each of their surfaces are carefully checked in a routine manner, there will be less danger of over-

looking areas which might prove to be dangerous if not discovered. In the examination of the teeth, it is important that each surface examined be free of saliva, food débris and gelatinous plaques. Air will remove the saliva and food particles, but an explorer is necessary for removing the plaques. Often, when cleaned of all foreign material, deep penetrating pits or fissures can readily be seen, in which there is often evidence of caries or in which an explorer will usually engage.

A diagnostic lamp, placed lingually or buccally from the tooth, readily discloses all pits and fissures and is an aid to determining the extent of caries involvement. This lamp is also excellent for demonstrating the defect to the parents of the patient.

X-ray films will disclose badly involved pits and fissures, but cannot be depended on in the incipient stages of this type of caries.

If a careful examination is thus made, the operator will probably be surprised to discover how few true pits are to be found upon the occlusal surfaces of the teeth. Too often, a portion of a fissure is marked and filled as a pit, and this will inevitably lead to a recurrence of caries. In this connection, I wish to make a statement which I have never seen in the literature, nor have I ever heard it made. Pits occur rarely in the occlusal surfaces of molars and bicuspids, as compared to fissures, with the exception of the lower first bicuspids. Perhaps this is not correct, but I believe it to be true. It is the result of close observation in examining and making fillings in thousands of occlusal surfaces. Usually, when the explorer engaged a "pit," a closer examination revealed that the pit was but a portion of a fissure. Because of the destructive nature of pit and fissure caries, we cannot be too careful in the diagnosis and classification of these cavities, previous to their operative eradication.

Precautions for Class I Cavity Preparation.—1. The rubber dam should be used wherever possible. 2. If the cavity has been marked as a pit, we should be doubly certain that it is a pit and not a portion of a fissure. 3. The type of bur best fitted to the condition is selected. For pre-carious cavities, these may be smaller, varying from a No. 33½ to a No. 34 inverted cone bur, a No. 699 to No. 701 tapering cross-cut bur or No. 556 to No. 557 straight cross-cut bur. 4. The precarious cavity should be kept small or narrow, as the case may be, but it is dangerous to keep it so much so that one cannot readily observe all portions of the cavity. On the other hand, the precarious cavity or one slightly involved by caries should not be extended radically, with unnecessary destruction of sound tooth structure. In most cases, the width of the bur is sufficient. In older patients, and in children presenting serious caries, it is best to extend the preparation until all laterally extending caries has been removed at the dentino-enamel junction.

5. If Dr. Black advocated the extension of Class I cavities one-third the distance upon the slope of a cusp, and the proximal margins to self-cleansing areas, it is many times more important to extend fissures to their extreme limits upon the surfaces of a tooth, because, by nature, they are the most unclean and susceptible portions of a tooth. To permit the margin of a filling to rest in a fissure is a certain invitation to recurrence of caries. Consequently, in order that fissures may be made as nearly immune as possible, it is extremely important that they be followed out to their limits.

6. The prepared floor of the fissure cavity should be carefully inspected for suspicious areas, which may easily escape one unless searched for. For this, it is well to use a disclosing solution, of which silver nitrate is one of the best. When it is placed in the cavity without reduction, any decalcified or carious areas remaining will immediately turn dark, at

times even black. They may also be detected by means of the diagnostic lamp, held buccally or lingually from the tooth, which will disclose all decalcified spots. Usually, such areas will be represented as small pits, from which they usually penetrate into the dentin from the dentino-enamel junction. These proliferations or finger-like penetrating areas may extend a remarkable distance into the dentin and often harbor caries. They are located mesially, distally and centrally, but may be found at any other point. Their positions represent the continuation into the dentin of defectively coalesced lobes of the tooth. Incidentally, these pitlike areas are very sensitive; which indicates the extent of acid penetration into the dentin. They should be explored by means of a small round bur. If little resistance is encountered, excavation is continued to its depth. If resistance is met, penetration of caries has probably not occurred and such a proliferation may be harmless. However, what may be found at the end of one of these proliferations is problematical.

The silver nitrate solution will also assist in the location of any laterally extending areas, which should also be excavated.

Whenever caries has been encountered within a pit or fissure cavity, ammoniacal silver nitrate should always be reduced and the cavity sealed until the next sitting, at which time the silver nitrate stain can be removed from the enamel walls, to prevent discoloration of the enamel. Prime has advocated this for many years. After this, the filling, properly inserted and polished, will complete the operation.

These precautions may appear to be too detailed, but the Class I filling is the most neglected of all our operative efforts. Whatever is done for the child patient may determine how long he is to have these teeth, the defective and dangerous natural condition of which we are considering in this paper. We cannot be too cautious in dealing with pits and fissures. Their care is a vital consideration.

7. The selection of filling material for the child patient merits the consideration of a number of facts, which will be brought out in discussing each of the possible materials.

Cements: Some dentists successfully use red copper cement in the fissure cavities. It is very enduring, but needs to be watched. The purpose of using it is to preserve the tooth until the patient is old enough to have a more careful cavity preparation for the permanent filling.

Silicates: These are also used; but I hesitate to recommend them, because of their past record.

Inlays: This type of filling should be used with the utmost caution and reluctance in the permanent teeth in the mouths of children. I should hesitate to place an inlay in a permanent molar tooth of my own child before 14 years of age. Prime says, "The inlay will be only as good as the cement with which it is set." Hollenback, after much study and experimentation, says, "The inlay is no better than the cement which holds it in position and the cement of today is far from being adequate." Further objections to the use of inlays for young permanent teeth are:

1. It is not always possible to apply a rubber dam for cavity preparation.

2. The radical cutting necessary for an inlay may be undue punishment for the child patient or for the immature tooth.

3. The area of preparation is usually larger than would be necessary for an alloy or foil filling.

4. If an inlay is the narrow fissure type, there is too great danger of distortion or shrinkage, with resulting dissolution of the cement.

5. If carelessly made, an inlay is a very dangerous filling. Its use may result in the loss of the tooth.

6. An economic loss may also occur.

If a proximal cavity appears later, it will be necessary to remove the occlusal inlay.

7. The inlay is no better than the cement holding it in place and the cement will disintegrate if the slightest margin is exposed.

Gold foil: Gold foil has been used extensively for children by some operators. Let us classify the foil filling according to the type of teeth in which it may be inserted for pits and fissures.

Molar teeth. The use of gold foil in molar teeth, except for pits, is contraindicated before 14 years of age, for the following reasons:

1. It is not always possible to apply the rubber dam.

2. The condensation of the foil is too much punishment for most children.

3. It may be dangerous to use, because of the immaturity of the pulp.

4. Access is not so good as will be the case at a greater age.

5. For these reasons, the best type of work is not always possible, and gold foil should never be used, unless the high type of technic which is necessary to foil fillings can be employed.

Bicuspid teeth. Because of the greater accessibility, the smaller size of the area of preparation and the shorter time necessary for insertion, foil fillings are indicated wherever parent and dentist can agree upon this quality of work. However, we must remember that there is danger of proximal cavities developing at a later age. If this happens, much of the work accomplished at the earlier age will have been done at an economic loss to the patient. Contraindications would be unusually large cavities under 16 years of age, which might lead to trauma or injury to the large immature pulp. Remember, these teeth normally erupt between 10 and 12 years of age and, therefore, are much less mature than the first permanent molar, which erupted at 6 years of age.

Anterior teeth. Lingual pit or fissure fillings which do not involve large areas may be safely placed for patients as young as 10 to 12 years of age.

Silver alloy filling material: The present-day silver alloy filling material has been perfected to such a degree that it is now one of the best filling materials available, on the following basis:

1. The use of an alloy approved by the standards of the American Dental Association.

2. The proper manipulation of the alloy.

3. The correct technical insertion in the cavity.

4. The polishing of the filling at a subsequent sitting.

5. A proper cavity preparation and sterilization, which are taken for granted.

FACTS RELATIVE TO PITS AND FISSURES

It is unnecessary to give a histologic presentation of pits and fissures in this paper. That has been done by Bodecker on many occasions. His various illustrations and those of others indicate the dangerous character of pit and fissure cavities. To the dentist, whose policy it is to wait until active caries can be seen in fissures before recommending filling, or the dentist who believes that they do not decay to any appreciable extent in the mouths of his patients, Dr. Bodecker says: "And of the great number of deep retentive grooves thus tested (using a ½ round bur), some of which were only slightly suspicious I have yet to find one which was not already carious. This applies to teeth which had been in function for two or more years." This is also Hyatt's experience. I can also vouch for a similar experience. Of many thousands of fissures filled, it can be unhesitatingly stated that not more than 1 per cent should not have been filled.

When we consider that many men believe that 99 per cent of all pits and fissures will sooner or later decay, there should be no hesitancy to enter and fill

all such cavities. Bodecker states that only two persons out of a hundred are immune to dental decay. Now, if the immunity were 5 or 10 per cent, or even 25, the filling of all pits and fissures would be justifiable. However, from the manner in which these defects are handled by them, dentists certainly must consider that most of their patients' teeth fall in the class of the immune. To be considered immune to dental caries, one should meet the following specifications: have no caries or fillings and have had no teeth extracted, and should be not less than 25 years of age.

According to the material gathered by Hyatt, from the examination of various groups of children and adults, first permanent molars have pits and fissures varying from 70 to 88 per cent in frequency and a loss of 46 per cent of all first permanent molars occurred in a group of 5,500 persons.[1] Major Leigh, of the United States Army, found in 8,000 young men, from 17 to 24 years of age, an incidence of occlusal caries of 69 per cent of all first permanent molars.[2]

The Hyatt Study Club concluded that:

A. The presence of caries at the bottom of a pit or fissure cavity is not always, or often, observable externally.

B. The degree of caries present at the base of a pit or fissure cavity cannot be definitely determined from external observation.

C. The progress of caries in occlusal pit or fissure cavities, because of its unobservable location, cannot be positively predicted by external observation no matter how frequently such an examination is made.[3]

If we dentists could only convince ourselves that pit and fissure cavities of the smallest size are dangerous to the health and life of the teeth, and fill them accordingly, during the time of childhood and young adult life, adults of the future would have much healthier mouths than do the adults of today. More than one-third of the population are dental cripples by the time they become of age —well started on the road toward a full set of dentures. Such tragedies may occur from the loss of a single tooth, from a single pit or fissure.

CONCLUSION

There were two reasons for the presentation of this paper: 1. To urge the dental profession to accept fully the classification of pits and fissures as true cavities. 2. To make a plea to the dentist to perform the highest possible type of operative dentistry upon the lowly Class I cavity.

There are several possible reasons why dentists do not promptly fill pits and fissures as soon as they are discovered: Faulty dental education, an attitude of watchful waiting, faulty diagnosis, failure to correlate the disastrous effect of pit and fissure caries with the existence of presumably harmless pits and fissures, and, lastly, an economic fear regarding the patient's reaction.

In the plea to the profession for better operative dentistry for these teeth, it was suggested that (1) a more thorough examination of Class I areas be considered, (2) the rubber dam be used wherever possible, (3) all fissures be extended to immune areas, which means extension to their extreme limits, (4) ammoniacal silver nitrate be reduced in the cavity wherever caries has been discovered, and (5) the best possible filling material be used, in most locations, before 16 years of age.

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THE SILICATES; WITH A REFERENCE TO ZINC PHOSPHATE CEMENTS

By J. W. Roush, D.D.S., Oakland, Calif.

THE silicate filling has come to be widely used for permanent restorations. One examination of more than 418,000 teeth has shown nearly 8 per cent of all the fillings to be of silicate cement.[1]

After many years of intensive study of the silicates, both in the laboratory and at the chair, I am of the opinion that this type of filling is the most difficult of all to insert. However, careful attention to the details of manipulation, together with "machine-like" execution of the technic, should be productive of fairly satisfactory silicate fillings; at least, fillings much improved over those ordinarily seen.

THE SILICATE POWDER

The powder of the simplest silicate is composed mainly of silica (SiO_2) and aluminum oxide (Al_2O_3) in the ratio 9:7.[2] These substances with small amounts of sodium, calcium and phosphorus are fused into a mass, generally by the aid of a fluorine flux. This mass, in turn, is cooled into a glass, which is crushed and ground to a powder.

THE SILICATE LIQUID

The silicate liquid is an aqueous solution of orthophosphoric acid, buffered with zinc and aluminum oxides in most instances.

Phosphoric acid solutions of this type tend to come into equilibrium with the humidity of the air when exposed, losing moisture on a dry day and absorbing moisture on a very damp day. This property calls for great care in handling the liquid. The powder should be on the slab ready for mixing. Five seconds is enough time to withdraw 2 drops of the liquid and restopper the liquid bottle. Mixing should proceed at once.

COLLOIDAL SILICATES

When the silicate powder and liquid are mixed, the mass hardens by the formation of a colloidal gel.[3] This noncrystalline or amorphous condition accounts for many of the differences in behavior between silicate cement and zinc phosphate (crown and bridge) cement, the latter being crystalline when set.

The following properties should be carefully observed in a study of silicate fillings:

1. The silicate filling is an irreversible colloid. Fractures occurring after hardening or gelation will never reunite.

2. The colloidal gel is composed of a matrix containing undissolved particles of powder and a certain amount of moisture. If the filling is allowed to dry out, some of the moisture is lost and the filling shrinks and cracks, much as moist wood shrinks and cracks when allowed to dry in the sun. Drying out is very harmful during the early setting stages. All silicate fillings should be well protected from drying out, by the use of cocoa butter or varnish, while dental work is being done.

3. When a filling again absorbs mois-

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ture after drying out, it swells or expands, but never quite to the original size, and the surface fractures remain as a defect.[4]

4. The zinc phosphate (crown and bridge) cements are considered adhesive and the silicates non-adhesive. Zinc phosphate cements set by crystals forming in the microscopic scratches or undercuts made in the cavity preparation by burs or cutting instruments. This crystal formation between the tooth and the inlay or crown acts in the manner of a lock, causing adhesion.[5] It is evident, then, that glazed surfaces are not ideal for cementation. Silicates do not crystallize, and therefore are almost entirely lacking in this adhesive property.

5. A cement that has the properties of both zinc phosphate cement and silicate

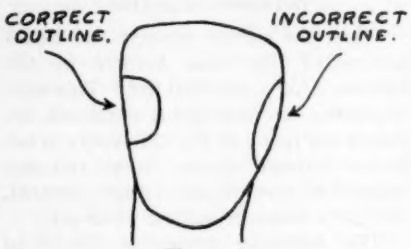

Figure 1.

is made by a mechanical mixture of silicate powder with zinc phosphate powder in the ratio 9:1.[2]

SHRINKAGE

Silicate cements have a tendency to shrink on hardening. If the acid concentration of the liquid is great, the filling will shrink less, but will have the following disadvantages: (1) danger of pulp irritation; (2) a slow setting of the mix, which may be quite serious, and (3) surface swelling on contact with moisture, resulting in a chalky surface that makes for poor color in a short time.

It is wise to get a new bottle of liquid if the mix sets too slowly.

The other extreme is frequently encountered. If the mix sets unusually rapidly when the temperature is around 70° F., the liquid may be exposed to evaporation for a few minutes and a test mix made. If this fails to satisfy, a new bottle should be secured. Such a fast-setting liquid contains more water, and its use will result in a filling that will shrink more. Closely related to this condition is that resulting from use of a thin mix, which also shrinks more.

It has been my experience that normal shrinkage is negligible in practice with proper cavity preparation and a technic otherwise well carried out. Improper adaptation of the filling to the cavity walls, and failure to hold the filling under pressure until set usually accounts for

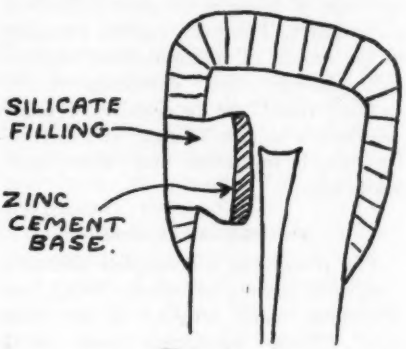

Figure 2.

the condition that is blamed on shrinkage.

HUMIDITY AND TEMPERATURE

It is the powder content of the cement which gives durability to the filling. The amount that can be incorporated in any given mix seems to be more dependent on the temperature of the slab than on any other fact. If the room temperature and the slab temperature are both high, setting reactions will be initiated, proceeding very rapidly. Spatulation begins to break down the gel as it forms, seriously weakening the final mix. Soon the hardening process makes it impossible to incorporate more powder and the result is

a mix with a small powder content and broken structure.

By all means, use of a hot slab should be avoided. A slab with a temperature of 60° F. or lower is far better, since much more powder can be incorporated and setting is greatly delayed during the mix. If the temperature of the slab is near the dew point, care should be taken to avoid incorporation of moisture in the mix. The chilled slab should be wrapped in several thicknesses of a dry towel until used.[6]

A large thick glass slab (or bottle containing cold water) is necessary in order to maintain a steady temperature, and a

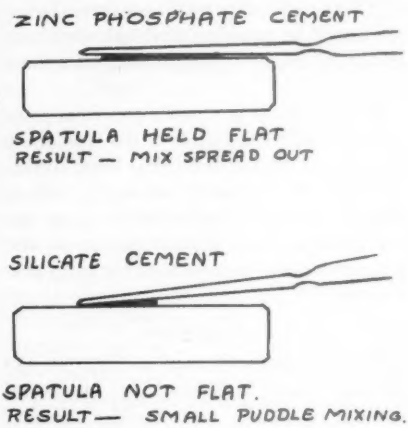

Figure 3.

thermometer within the slab is desirable.

A draft from an open window or an electric fan is very undesirable during mixing. Boiling water in an open sterilizer or in an adjoining laboratory may greatly affect the humidity of the office if the windows are closed.

SOLUBILITY AND DISINTEGRATION

Acid or alkaline conditions of the strength found in the mouth are not important factors in the life of a silicate filling when the surface of the filling has not been prematurely exposed to air or moisture. My observation in this regard coincides exactly with that expressed by W. Clyde Davis in "Clinical Operative Dentistry."[6]

The human element must not be overlooked in a study of the life of a dental restoration. The "wear and tear" is different in different mouths. The different types of food eaten, the force of the bite and harmful personal habits, as well as the viscosity of the saliva, should be considered in studying the lasting qualities of silicate fillings.

CARIES IMMUNITY

There seems to be a quality in silicate fillings that repels the bacteria of tooth decay, for it is common observation that secondary decay is rarely seen around a

Figure 4.

well-placed silicate filling. An approximating surface with sound enamel will usually remain sound where it contacts the silicate. In making observations on silicate immunity, sediment must not be mistaken for decay.

PULP INVOLVEMENT

In days gone by, pulps under silicate fillings were frequently found to be dead. This is not so common now as formerly; in fact, with proper technic, it is rarely encountered.

Pulp death under silicates may be chargeable to any of the following conditions:

1. Acid irritation. This effect is mostly spent during the first twenty-four hours.

In most instances, the liquid is at present buffered with zinc and aluminum oxides, and this seems to reduce the harmful effects materially. With all this, it must be remembered that thin mixes will have much free acid to liberate. The large pulps of children's teeth and dentinal tubules of greater diameter call for special care in pulp protection.

2. Carious infection. The pulp may have become infected before filling or all of the decay may not have been removed.

3. Compression. A thin pulpal wall may have been compressed against the delicate pulp during placement of the filling. Deep cavities should be wiped well with phenol and a layer of zinc phosphate (crown and bridge) cement

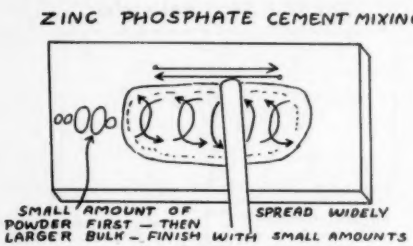

Figure 5.

flowed against the pulpal wall as a base.

4. Pulp exposure. A slight exposure of the pulp during the cavity preparation may have escaped notice at the time, especially if the preparation was made under a local anesthetic.

Zinc phosphate cement has long been used as a base in deep cavities. The pulp tolerates such a base even though the zinc phosphate liquid is more acid than the silicate liquid. The reason lies in the condition of the final "set" of the cement.

The silicates set "wet" and readily give off an acid moisture to the tooth structure in the early setting stages. The filling must retain this moisture throughout its life or it will bleach, shrink and crack. This is not water of crystallization.

The zinc phosphate cement, on the other hand, sets "dry," from all outward appearances, forming a crystalline inert zinc phosphate that does not give off moisture to the tooth structure. It contains water of crystallization, but this is intimately locked in the crystalline structure, and only in case of a very thin mix is there likely to be irritation from free acid, except for a few minutes.

PROTECTION FOR THE PULP

The following measures protect the pulp: (1) application of phenol (95 per cent) and drying with an air syringe; (2) lining of cavity with an ethereal solution, such as copalite, and (3) very near the pulp, use of a base of zinc phosphate cement.

If the mix is not made too thin, most cavities will not require the foregoing treatment. If the tooth has been hypersensitive or has been aching, a silicate should not be placed until the pulp has been restored to a normal condition, and then only with precautions for pulp protection.

INDICATIONS

Silicates are indicated in (1) pit and narrow fissure cavities; (2) proximal cavities in incisors and cuspids; (3) facings for gold inlays; (4) facings for full veneer gold crowns, and (5) temporary jacket crowns, using a celluloid crown form.

In gingival third cavities, the use of silicates is not very desirable, especially where the gingival margin lies beneath the gum. Among other faults, gum irritation is usually evident against the roughened silicate.

CAVITY PREPARATION

For cavity preparation, the following should be observed:

1. The cavity should be as small as possible, yet large enough to be filled properly.

2. Margins should be kept at right angles to the tooth surface. By planing or the use of very fine cutting stones, margins should be made very smooth and sharp, with no cavosurface bevel.

3. Undercuts are made for retention and security of adaptation against cavity walls by cutting a small round bur channel in the dentin just beneath the margins of the cavity.

4. In order to assure good results in filling a cavity with silicate, it is necessary to have easy access.

A small electric light, as from the unit, held lingually or labially from the cavity by the assistant, will be a great aid in removing every vestige of stain or decay in anterior teeth. A little stain often shows through the enamel when silicate is placed as a background, making an unsightly filling.

COMPARISON OF SILICATE MIXING WITH ZINC PHOSPHATE MIXING

Zinc phosphate cement is mixed with the spatula held flat on the slab, with a rotary motion, together with long strokes over a large area to dissipate the heat of reaction. Small amounts of powder are thoroughly incorporated, then larger amounts, and again small amounts until the desired consistency is attained. The mixing should be rather deliberate; for introduction of the small amounts of powder at the beginning of mixing will slow down the reaction and give ample time for thorough spatulation.

Silicate cement, on the other hand, is mixed by using the outer third or half of the spatula blade, with the handle slightly elevated from flat. This will, on using a rotary motion, keep a small puddle of the mix and prevent evaporation or acquisition of moisture during the mixing process. A large amount is incorporated at first, then successively smaller amounts of the powder, until the desired thickness is attained. The silicate mixing should not take more than one and one-half minutes.

Both cements should be mixed on quite cool slabs. In the case of both cements, the whole mass is scraped up from time to time and freed from the spatula by the familiar "turn-and-swipe" movement. Too much folding over of the mix during spatulation will tend to incorporate air bubbles in the mix of either cement.

INSTRUMENTS AND MATERIALS

The instruments and materials employed are as follows:

1. A large thick glass slab with thermometer enclosed.

2. An agate or a stellite spatula.

3. A stainless steel packing instrument. (The Hollenback wax carver is excellent for this.)

4. A stainless steel explorer, to release trapped air from the filling.

5. An ethereal varnish cavity liner, such as copalite.

6. Cocoa butter in plastic or grease form.

7. Thin celluloid strips, fine disks and fine cloth strips.

8. Heavy varnish for final covering of filling.

SILICATE MANIPULATION AND PLACEMENT

1. The celluloid strip is adapted and the strip held in position over the empty cavity before mixing is started. The strip is left in place. Inserting the strip after the cavity has been filled is apt to drag the material away from the incisal margin and will consume valuable time during the rapid setting stages.

2. Mixing is started as soon as the liquid is placed on the slab. The shorter the time of mixing the better, for silicates, provided, of course, thorough spatulation is maintained. A 2-drop mix can be made in less time than a 3-drop or a 4-drop mix, and a 2-drop mix is large enough for nearly all fillings. After a few 2-drop mixes are made, the technic will seem easier and the fillings usually will be improved. The total mixing time

should be not more than one and one-half minutes, preferably less.

As much powder is incorporated as is possible without loss of plasticity. If plasticity is lost, a new mix is imperative.

3. The whole mix is gathered on the spatula, which the assistant holds near the cavity. Very small amounts of the filling material are taken up on the tip of the Hollenback instrument and packed into all the undercuts of the cavity and against all walls. The cavity must not be overfilled. Trapped air can be released at this point, if it is thought necessary, by inserting the explorer in the mass of filling and agitating it for a second. The explorer will be found to be of great aid in packing very small cavities.

4. The strip is drawn and held under pressure for several minutes. Pressure will make for surface density by compressing the air spaces and forcing the moisture beyond the cavity margins. The excess filling material is removed from the spatula and kept on the side as a test sample as to the setting time for that mix. This is the only way to be sure of proper hardness before the strip is released.

5. With the cocoa butter ready, the strip is released and immediately the cocoa butter is placed labially and lingually on the filling. Then the cocoa butter is spread interproximally by a backward and forward pulling of the strip. Next, the strip is removed and the filling left for a few minutes with a cocoa butter covering. Silicate does better under an oil or grease than under any other medium.

6. The excess cocoa butter is wiped off and the oily surface of the filling is covered with varnish, which adheres to the tooth surface beyond the filling. The varnish is applied interproximally with the strip also, and is allowed to dry in the atmosphere undisturbed. This is much better than using an air syringe to dry the varnish.

7. Polishing is carried out at a subsequent sitting, with much cocoa butter. The disk or strip is lifted frequently to prevent frictional damage.

8. Only one filling should be made with one mix. If two adjacent cavities are to be filled, both cavities are prepared before filling either. The strip is left in place after one is filled and covered with cocoa butter. A new mix is then made and placed in the adjacent cavity and the strip reversed away from the first filling and held with pressure on the second. Leaving the strip in place will prevent the cocoa butter placed on the first filling from getting into the adjacent unfilled cavity or on its walls.

Celluloid facing forms may be used as matrices for facings or for gingival third cavities. Modeling compound or gutta-percha is often used as holders for the strip when irregularities exist in tooth alinement.

CONCLUSION

I have put special emphasis on the technic of silicate work in this paper because the difference in results at the present time depends a great deal more on the technic than on a particular brand of silicate used. With all, however, I do not wish to leave the impression that all brands of silicate have equal merit.

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CONSEQUENCES OF SHORTENING THE INTERMAXILLARY DISTANCE

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THE work to determine the consequences of shortening the intermaxillary distance has been divided into three phases: (1) historical; (2) clinical, experimental and statistical investigation, and (3) research on experimental animals, in preliminary stages.

HISTORICAL

We have before us several theories as to the cause of the concomitant symptoms of closed bite:

1. Pressure on the meniscus and bony structures of the joint causes denudation of the bones of their cartilage and perforation of the meniscus.

2. The position of the condylar head causes deafness by occlusion of the external auditory canal.

3. The position of the condylar head causes deafness by occlusion of the eustachian tube from pressure on the adjacent soft tissues.

4. The pharyngeal orifice of the eustachian tube is occluded by decrease in tension of the tensor and levator muscles, causing deafness.

5. Pressure on the chorda tympani and anterior tympanic nerve and artery causes pain, tinnitus, glossodynia and pharyngeal paresthesia.

6. Pressure on the auriculotemporal nerve causes tinnitus and pain symptoms.

Many reports begin with an almost routine anatomic description of the region under discussion, ostensibly pointing out the close relationship of the parts involved. Yet no anatomist has been able to verify their claims or discern the connection. In fact, the only anatomist who has voiced his opinion on the subject, Batson,[1] professor of anatomy at the University of Pennsylvania, has definitely denied any relationship. He says:

> Much that has been said and written about the relationship between malfunction of the temporomandibular joint and disturbances of the function of hearing has been casual and needs to be discarded. . . . To my knowledge, no one has advanced a plausible explanation which would establish the closing bite as a causal factor in this type [nerve] of deafness. . . . I have been unable to find any reports . . . in which adequate hearing tests have been made before and after opening of the bite to show the state of hearing. . . . I am still looking for a clear-cut case of improvement. . . .

He refers to Shambaugh, who says:

> We have yet to see any case of deafness . . . ascribed to temporomandibular joint malocclusion. . . . [It] must be very uncommon, and we suspect . . . greatly overemphasized.[1]

In 1918, Prentiss[2] discussed the perforation of the semilunar cartilage and its similarity to the perforation of the meniscus. In more severe cases of closed bite, atrophy of the condylar head and fossa was evident. The histories of these cases are not given.

Conners[3] proposed to determine whether anatomic evidence supported the contention that alterations in the occlusion are accompanied by atrophy in one or both menisci. He points out that the menisci are composed of white fibrocartilage, which is found in other regions

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of the body where great strength and a certain amount of rigidity are desirable, and that the white connective tissue fibers scattered throughout are the most active regenerating tissue in the body.

He mentions (after Gysi) that the balancing condyle transmits heavy pressure to the thick eminentia and that, even under normal conditions, the center of the meniscus (area two) receives heavy pressure; while, on the working side, the anterior third (area one) of the meniscus receives light pressure or even undergoes tension. To cite examples throughout the body: It has been found that only continuous pressure, of moderate or extreme intensity, will cause death of tissue; whereas intermittent pressure of great intensity can produce only hypertrophy.[3] This is substantiated by Pringle,[4] who says, "I have invariably found that there is a very decided central thickening of the disc."

Conners suggests as other possible causes of erosion of the disk or condylar head arthritis or some suppurative process. The mere rubbing together of two bony areas would not produce erosion, but highly polished areas; as, for example, in fracture of the jaw, wherein a new articulation is formed.

One other writer, Fick, says perforation of the interarticular disk is a rarity.

These references are believed to be adequate refutation of Prentiss' work, since no one has been able to confirm his findings.

Throughout the literature, and climaxed by an editorial in THE JOURNAL, are other examples of unscientific procedure and clashing opinions.[5] Monson[6] conservatively makes his hearing tests "in a quiet room—and the same watch should always be used." Decker[7] uses the whispered voice, a tuning fork and a watch. Smith,[8] too, depends on a watch and a whisper to test hearing, giving one test before and one test after treatment. He quotes numerous men on deafness from blocking of the tube, including Rich, who in turn quotes "many authorities on covering the muscle control of the eustachian tube, the preponderance of belief being that the tube is open only during swallowing and yawning," although some men state that it is closed during deglutition. He then departs from this almost universal belief and states that the tensor palatini muscle alone is responsible for any change that occurs in the patency of the pharyngeal orifice of the eustachian tube. If one observes the pharyngeal orifice of the eustachian tube through a nasopharyngoscope, he will observe that the slightest movement of the mandible will cause dilatation of the orifice.

Costen[9] appears to be the first to have described the associated symptoms of intermaxillary closure; hence, they have all come to be described as Costen's syndrome. He does not say how many cases had erosion of the condylar head and eminentia, nor how this was determined; nor does he give the history of the patient; that is, he does not say whether any arthritis or suppurative process was ever present. He states that in twelve cases out of sixteen the hearing was improved. The method of improving the hearing, the amount of increase in hearing, or the number of tests taken before and after the treatment are not given.

Many other men have based their reports on Costen's theories without doing any impartial scientific work of their own; for example, G. H. Wright,[10] Gillis,[11] Bleiker[12] and Harris,[13] the last stating that amazing improvement occurred in a case, and apparently having audiograms to substantiate his claims. First, in refutation, these audiograms are for speech and are not made with an audiometer, and, secondly, only one test was made before treatment. The day the dentures were inserted, there was an improvement of

Right	35-40-45-50-55-65-55	decibels
Left	50-60-50-55-50	decibels

I contend that this change would have been observed without any appliance.

The net change at two years from the date of insertion (second audiogram) is
Right (-5)-(-5)-(-10)-(-10)-0-10-0-(-5)
Left 0-0-(-5)-(-5)-5-(-10)-0-(-5)
Further, could Harris state without hesitation that one can control the volume of the voice over a two-year period without wavering a decibel?

CLINICAL, EXPERIMENTAL AND STATISTICAL INVESTIGATION

Pertinent to the problem of proper intermaxillary dimension, a sequential experiment developed. Ralph Boos, of Minneapolis, devised an instrument of central bearing point type, with a pressure gage attached, which could be mounted on individual vulcanite trays. His theory was that the patient could exert the greatest biting force at the normal working bite, and therefore the proper opening could be determined by finding the point at which the patient could bite the hardest. From the experiments made, we could not substantiate this theory. As a rule, the more we increased the intermaxillary distance, the harder the patient could bite.

For a series of forty-nine cases, a routine was followed in which study model impressions were taken; full mouth and temporomandibular joint roentgenograms in centric occlusion and opened without protrusion were taken (using a Bullitt mastoid apparatus to fix the head in relation to the x-ray tube), and an audiogram was made. This was followed by working model impressions, at least one more audiogram, further roentgenograms (extra-oral and intra-oral, if needed) and compound bite-blocks in centric relation at the opening desired, and in lateral and protrusive ranges.

The master models were mounted on a House articulator and the condylar paths set, using the compound blocks. Bilateral splints, generally, for both upper and lower jaws, their placement depending on the amount of opening, were waxed on the models, invested and cast in coin silver.

The finished splints were checked in the mouth for balance, and for any possible interference from cusps that was not eliminated on the articulator, since one cannot rely implicitly on check-bites for accuracy in setting an articulator. Before the splints were cemented to place, an audiogram was made. If a change of more than 15 decibels was noted, another audiogram was made. Another was made as soon after the cementation of the splints as could be arranged with the Nose and Throat Department of Presbyterian Hospital. This period might be a week or ten days. A series of audiograms would then be taken over an indefinite period of time. We always made at least two or three audiograms before and after the bite opening was completed.

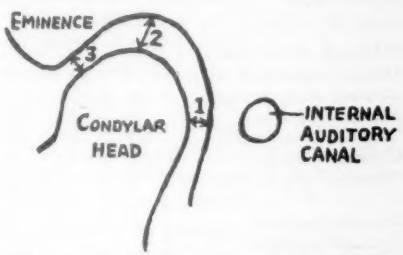

Fig. 1.—Positions measured in Table 1: 1, mastoid, 2, glenoid, and 3, articular eminence.

It is evident from Table 1 that the difference between the normal and the abnormal closed mastoid readings is hardly enough to cause occlusion of the external auditory meatus, particularly when it is noted that, on one side, the low for the normal was less than that for the abnormal. In none of the roentgenograms was there any evidence of bone destruction to permit such occlusion. In fact, all the readings, with the exception of the open mastoids and open articular

eminence, are nearly identical. In the latter case, there was one very high reading, elimination of which brings the average nearer the normal. These figures are in parentheses. Of the other, I know of no plausible explanation as to why the abnormal condylar head should have a greater range of sliding movement than the normal. From these figures also, it hardly seems plausible that the condylar head causes pressure on the eustachian tube. Furthermore, I should like to point out that in extremely radical ear operations, the entire posterior wall of the fossa is removed without interfering with the eustachian tube in any manner whatsoever.

In none of the roentgenograms of the abnormal cases was there any visible evidence of irregularities, bone destruction or other abnormalities of any of the bony joint structures.

TABLE 1.—ANALYSIS OF TEMPOROMANDIBULAR JOINT ROENTGENOGRAMS

Position Measured	No. of Cases	Average Reading Mm.	No. of Cases	Average Reading Mm.	High Mm.	Low Mm.	No. of Cases	Average Reading Mm.	High Mm.	Low Mm.
	Combined		Normal				Abnormal			
*Mastoid—closed right	64	2.8	36	2.9−	7.6	0.6	28	2.8	4.3	1.4
Mastoid—closed left	64	2.5+	36	2.8	6.3	0.6	28	2.5	3.9	0.6
Mastoid—open right	38	10.7	18	8.6+	14.0	2.2	20	12.1	20.4	4.8
Mastoid—open left	38	10.8	18	8.5	16.7	2.7	20	12.9	20.2	5.0
Glenoid—closed right	61	2.9	34	2.7+	4.9	1.4	27	2.8+	6.3	0.9
Glenoid—closed left	60	2.7	33	2.6	4.8	1.2	27	2.5−	5.8	0.7
Glenoid—open right	14	5.5	10	4.9	9.1	2.4	5 (4)	9.8 (7.1)	20.4 (8.1)	5.9
Glenoid—open left	12	4.3	9	3.7	8.0	1.5	3	6.0	7.3	4.7
Articular eminence—closed right	56	1.7−	33	1.7−	3.4	0.7	23	1.5−	3.4	0.5
Articular eminence—closed left	47	1.7+	30	1.8+	3.5	0.7	17	1.4+	2.3	0.7
Articular eminence—open right	35	1.7	17	1.6+	2.3	0.7	18	1.9	7.0	0.6
Articular eminence—open left	32	1.9	15	1.6+	2.8	0.4	17 (16)	2.2 (1.4)	13.5 (2.8)	0.6

*In the illustration, the distance between the condylar head and 1 is the mastoid; 2, the glenoid and 3, the articular eminence.

AUDIOMETRIC EXPERIMENTS

In an article entitled "Inherent Accuracy of a Series of Repeated Clinical Audiograms," Witting and Hughson[14] reported the results of their "endeavor to obtain a quantitative determination of errors in hearing measurements on hard of hearing patients and the probable relationship between the errors on hard of hearing and normal individuals." They worked on seventeen patients, all of whom had conduction deafness of an average duration of eight and six-tenths years. Ten of these had tinnitus. No less than ten audiograms were made for each patient. No treatments were administered during the research period. The conclusions were:

1. There is an inherent error of slightly less than 5 decibels, 1,024 double vibrations per second being the most accurate.

2. Large occasional deviations from average are experienced and remain unexplained . . . [and] are to be expected in hard of hearing patients.

3. Three audiograms are recommended whenever accuracy is desirable, since the possibility of error is so much less than with one audiogram.

4. There is a slight rise in the apparent acuity of hearing as registered by audiograms from the first of a series to the last, even when time intervals of over two years from first to last have elapsed.

An average audiometer is calibrated in 5 decibel steps. In addition to this, the patient may vary 5 to 10 decibels in his responses. This makes possible a 15 decibel margin of error. In distance for a quiet voice, for a normal ear, this means the difference between 22 feet and 125 feet. It is evident, therefore, that an apparent "improvement" of several feet in hearing acuity for the whispered voice may be negligible when measured with an accurately calibrated sound source, such as an audiometer. Furthermore, accurate measurements of the loudness of the whisper and of the voice has shown that they vary tremendously in different individuals and even in the same individual. The variation is so great with the outside masking the noises of an ordinary room that no quantitative measurements made by this method are of any value whatsoever.

Further experiments along this line by Fowler[15] show that, on moving the source of sound 4 meters, there is a loss of only 10 decibels (which is within the foregoing range). Fowler's conclusions are:

1. A sound-damped and sound-proof room is essential for testing.

2. Extraneous sounds change the threshold more than the distance of the sound source.

3. Extraneous sounds affect the loudness of the voice and the whisper of the examiner.

4. Extraneous sounds affect the whisper less than the voice.

5. There is an average threshold for normal patients for the sound being used.

6. If an audiometer is being used, its calibration should be noted (in a room sound-proof or otherwise).

7. Detailed data of testing methods often are lacking.

8. Normally, there is considerable variation in the threshold of hearing, often greater in diseased ears. This must be considered in any procedure to improve hearing.

We know that there is a threshold noise of 20 decibels in a quiet office and 30 decibels in an average office. This means a given sound (whispered voice) can be heard at a distance of 4 feet in one and 15 inches in another. In other words, a patient would hear a given sound under different conditions at a wide variation of distances from the sound source, even though no treatment were given. Conversely, this variation in distance after treatment does not indicate that much improvement. It may be due entirely to change in the threshold noise. Furthermore, a change of 15 decibels in a sound-proof room is required on an audiogram before we consider it an improvement. Anything less than that is insignificant and inaccurate. Transferred to terms of whispered voice, this means a given sound could be heard at an increased distance of 32 feet.

Fletcher[16] says,

> It is generally recognized that it is almost impossible to obtain accurate results by means of the usual speech methods because of the uncertainties of controlling the intensity of the voice, the noise, and acoustic conditions of the testing room. . . . If the tester should use the pp. voice (loud whisper) and find the hearing distance one foot before treatment and then in the test after treatment (in his anxiety) raise the intensity of his voice to mf., he would increase the hearing distance to five feet without change in the patient's ability to hear.

Nor does he consider the use of a

watch as accurate, since objects in the room, particularly the patient's head, may produce reflections and irregularities. The watch sound is about 2,000 cycles per second, and definite reflection patterns are produced by objects at high frequency vibrations more than at low. It is the high frequency tone losses that we most commonly encounter.

The primary objection to the tuning fork is the amount of time it takes to conduct a series of examinations.

TABLE 2.—AUDIOGRAMS OF TWO EXPERIMENTAL CASES

Test	Ear	* 128	Change	* 256	Change	* 512	Change	* 1,024	Change	* 2,048	Change	* 4,096	Change	* 8,192	Change
1	R	12		12		15		12		12		20			
	L	15		20		20		18		18		20			
3	R	8	4	10	2	10	5	10	2	12	0	18	2		
	L	10	5	15	5	15	5	10	8	12	6	18	2		
1 Spl't†	R	15	−7	10	−5	10	0	10	0	10	2	15	3	5	
	L	15	−5	15	0	10	5	10	0	10	2	15	3	15	
3 Spl't†	R	5	10	10	5	8	2	8	2	8	2	12	3	15	0
	L	5	10	10	5	8	2	8	2	8	2	12	3	12	3
Net change with splint	R		3		0		2		2		4		6		
	L		5		5		7		2		4		6		
1	R	20		20		25		25		25		25		25	
	L	8		12		10		18		12		25		35	
2	R	20	0	18	2	18	7	20	5	18	7	12	13	12	13
	L	8	0	10	2	10	0	15	3	10	2	10	15	12	23
1 splint†	R	10	10	12	6	8	10	10	10	15	3	25	−13		
	L	8	0	12	2	8	2	10	5	15	5	25	−15		
3 no splint	R	10	0	12	0	10	−2	10	0	12	3	10	15		
	L	10	−2	12	0	10	−2	10	0	8	7	10	15		
1 splint	R	5	5	5	7	5	5	5	5	12	0	5	5	10	2
(2)‡	L	10	0	10	2	5	5	5	5	10	−2	12	−2	10	2
3 splint	R	10	−5	10	−5	5	0	5	0	12	0	12	−7	5	5
(2)‡	L	10	0	10	0	10	−5	10	−5	10	0	12	0	10	0
Net change with splint	R		0		2		5		5		0		−2		7
	L		0		2		0		0		−2		−2		2
#	R		10		10		20		20		13		13		20
#	L		−2		2		0		8		2		13		25

* Double vibrations per second. † Test number after splints were cemented. ‡ Test number after second set of splints were cemented. # Difference between first and last audiogram.

Confronted with this barrage of exceptions, it is difficult to see how certain authors can justify their claims of improvement of the hearing when they have no accredited, accurate method of proving their statements.

Using this as our basis, we proceeded to make a series of audiograms before and after the bite-opening operation was undertaken. Table 2 presents the audiograms of two of the cases in the experiment. All tests were made on a 5 A audiometer in a sound-proof, sound-damped room.

First, it appears evident from these readings that there is a certain amount of practice element or improvement in the audiograms without any treatment—in one instance, an improvement of 23 decibels. This practice element is well known to nose and throat men. That is why a series must be taken before treatment is undertaken.

Secondly, the administration of splints, while it did relieve all other symptoms, did not appreciably affect hearing ability.

The cases treated with the infra-red lamp and rest were in young girls, who apparently had opened their mouths too wide, with consequent mild damage to the joint structures.

The one patient who had a typical eustachian type hearing loss was not relieved by splints, and neither did splints relieve his tinnitus.

Of the twenty-eight cases in which joint symptoms were relieved, only nine showed tinnitus, and seven of these were relieved. This is difficult to interpret. If bite opening can relieve this symptom and yet not improve hearing, we have the alternative conclusion that closure causes irreparable damage in some way or that, as Costen believes, closure causes pressure of the internal pterygoid against the eustachian tube, with subsequent blocking of the tube. This eventually would cause suction on the membrane of the round window with a consequent osmotic change in the ionic concentration of the perilymph. Any such change would cause tinnitus. This theory is difficult to demonstrate with sectional specimens, since there will be a certain amount of movement of adjacent tissues or movement of the jaw because of rigor mortis. Whether the same thing happens in the living person, it is difficult to determine. Furthermore, it is factual, as determined

TABLE 3.—SUMMARY OF FORTY-NINE CASES

	No. of Cases	Normal Hearing Loss 10 Decibels	Uniform Partial Loss 20 to 70 Per Cent	High Tone Loss	Eustachian Type Hearing Loss	Cases Treated	Infra-red and Rest	No Relief Joint Symptom	Relieved Joint Symptom (Pain, Etc.)	No Relief of Tinnitus	Relieved Tinnitus	Improved Hearing
Syndrome cases	32	15	12	6	1	32	3	2	28	2	7	0
Closed bite—no other symptoms	5	5				0	0		0		0	0
Symptoms of non-oral origin	12	3	3	4	2	4		1	1			2

by the nasopharyngoscope, that the slightest movement of the jaw causes synchronous movement of the palatal muscles and dilatation of the pharyngeal orifice of the tube, and it is probable that there also is synchronous movement of the internal pterygoid muscles and dilatation of the tube.

Thirdly, we must consider also the fact that relief of tinnitus and bite opening may be concomitant. One of these seven patients found relief by this means; and, on removal of the splints, occasional pains in the joint region recurred, but the tinnitus did not. This may mean that closure has no effect on the auditory system whatsoever and that the tinnitus is due to some other condition.

Of the closed-bite cases, half had normal hearing (loss of less than 10 decibels), and no improvement in hearing was observed in the other cases although all pain symptoms were relieved. No mention is made of x-ray diagnosis in this chart since, as can be noted from the previous chart, no differentiation could be made between the normal and the abnormal.

It will be noted that a considerable number of these patients are slightly unbalanced mentally. Not included among these patients are a series treated for hearing loss by saline injections on the pretense that prostigmin was being administered. Invariably, the hearing improved subjectively and audiometrically. Similar results were obtained for prostigmin, although some patients prefer, in fact plead for, saline injections.

We must include a few words concerning the symptom of dizziness, which, we think, is sometimes a result of bite closure and which, we believe, we have sometimes cured by opening the bite. Page O. Northington (a member of the Presbyterian Hospital staff, Nose and Throat Department) has observed, for a period of two years, eleven out of twelve patients who had such severe attacks of dizziness that they were admitted to the Neurological Institute. These eleven patients did not receive any treatment, and yet, at the end of the two-year period all were free from attacks of dizziness. In other words, we are combating here a peculiar symptom which undergoes recurrence and recession without any apparent cause, and we should be cautious therefore not to overvalue its treatment by opening the bite. Some authors believe that there is a connection between bite closure and loss of hearing because the patient will sit open-mouthed when listening intently. This is not to aid hearing. It is an exaggerated rest bite position of complete relaxation with extreme attention devoted to listening. One finds the same relaxation in sleep, with snoring as a result. The twelve cases with tinnitus and high tone loss of unknown source without any oral symptoms whatsoever and the five cases of reduced intermaxillary distance with normal hearing were included to point out that these symptoms of closure and loss of hearing and tinnitus are not always concurrent or related.

This leaves the two opposing theories that (1) pressure on the chorda tympani and anterior tympanic nerve and artery causes the pain and ear symptoms, and (2) pressure on the auriculotemporal nerve causes pain; theories that are hard to prove. I fail to see, first of all, what causes the pressure. Furthermore, it is difficult to conceive just how this connection takes place, despite the sympathetic involvement, since the cochlea derives its blood supply from the internal auditory branch of the basilar artery just below the circle of Willis, which arises from the vertebral artery and has no connection with the external carotid system whatsoever. It cannot be the condylar head, if any faith is to be placed in these x-ray measurements. If relief were given without changing the relation of the condylar head to the fossa, how could pressure result on the adjacent tissues in the unrelieved position?

It also has been pointed out by Higley[17] that complete severance of the chorda tympani, in radical mastoid operations, is inconsequential. Some assume that pressure on these soft tissues is the cause of symptoms, unnoticed by the patient, but they have forgotten one cardinal concept of the physiology of the body—that bone is the most yielding of all tissues. Yet no one has offered indisputable proof that underlying bone has been destroyed by pressure on these tissues. These followers of pressure theories assume without proof that the condylar head exerts tremendous force on the fossa and adjacent tissues. It is believed that, in certain actions, there is actually a negative pressure on the fossa (for example, on biting on a hard object in the molar region); the greatest positive pressure is transmitted to the eminentia, not the fossa, and pressure is transmitted in biting in the protrusive position.

We are not at all certain that the fossa actually determines the condylar path. Perhaps it is all a problem of muscle dynamics; that is, the mandible is cradled in two slings of opposing muscles, and it is possible that the interaction of these muscles determines the direction of movement of the mandible. It may well be, then, that, with closure, these opposing forces are unbalanced, some muscles being stretched, others flexed, with a consequent tiring of the muscles, much as any other muscle would begin to ache if held in a state of flexure.

We are seeking a solution of this problem by the use of experimental animals so that we can produce various abnormalities and study the results in the living, as well as study gross and histologic findings in animals, which, of course, is impossible in human beings.

CONCLUSIONS

1. Statements regarding the improvement of hearing by increasing the intermaxillary distance have no scientific proof.

2. Increasing the intermaxillary distance does not improve hearing ability, as is shown by audiograms.

3. Increasing the intermaxillary distance does relieve tinnitus and pain about the temporal, parietal and masseteric areas in a great majority of cases. The reason for this is unknown.

4. Temporomandibular joint roentgenograms do not show any appreciable difference between normal and abnormal cases.

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SOME ENDOCRINE FACTORS IN DENTAL DEVELOPMENT AND MAINTENANCE

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THE health of the teeth may be impaired by disorders of the endocrine glands in two fundamentally different ways.

1. Directly, by interference with normal tooth formation and eruption.

2. Indirectly, by interference with normal growth or maintenance of the supporting structures.

The first type of change can take place only during the stage of formation, growth and eruption of the tooth. The second may occur at any time of life, although its effects are chiefly postnatal.

Before formation of the bony structure of the jaws, at about the eighth week of embryonal life, the tooth buds and the enamel organs of the deciduous teeth are formed. The enamel organs of the permanent teeth begin to form at about the sixteenth week of intra-uterine life. At birth, all the teeth but the second and third molars have begun to develop and the crowns of the deciduous teeth are partially or completely formed. At about 6 to 8 months, the first deciduous tooth erupts; at about 2 years of age, the last one erupts. The first permanent molar erupts at about 6 years of age.

These facts, well known to dentists, remind us of the early age at which various conditions may operate to affect the health of both deciduous and permanent teeth. Many conditions of prime importance, such as the results of infectious disease and nutrition, especially those relating to minerals and vitamins, are intimately associated with the changes in metabolism governed by the endocrine glands. In clinical practice, the separation of these various conditions may be impracticable. Only the endocrine factors are within the scope of this paper.

HYPOTHYROIDISM

The endocrine disorder most clearly related to dental formation and rate of eruption appears to be thyroid deficiency. As pointed out above, such a deficiency is of the greatest importance during pregnancy and in early childhood.

In the adult, hypothyroidism of a severe degree produces myxedema. It can be diagnosed readily if kept in mind. Mild thyroid failure, however, must be searched for with care. It is especially common in certain areas where the soil and water are deficient in iodine. In

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modern times, people move so freely from one location to another that geographic distribution of the disease is not so evident as it was previously. In such areas as the Great Lakes region, where goiter is common, the condition should be considered a possibility in all expectant mothers and treated thoroughly if found. Such treatment would be of great value in the prevention of poor dental health in children. Whenever a suspicion of hypothyroidism is present, dentists might remind the obstetrician of such a possibility or recommend consideration of a possibility of hypothyroidism of mild degree in expectant mothers who come under their care.

memory, irritability, drowsiness and, at times, digestive and menstrual disorders. The most obvious sign is edema of the eyelids or, in more advanced cases, of the face, hands and feet. There may be a gain in weight, although obesity is seldom extreme. The most striking changes are the low basal metabolic rate, which responds completely to thyroid therapy, and blood cholesterol levels exceeding 225 mg. per hundred cubic centimeters. From a dental point of view, the condition is unimportant in the adult, but it is important that it be recognized and treated during pregnancy.

In infancy and childhood, thyroid deficiency varies greatly in severity. It

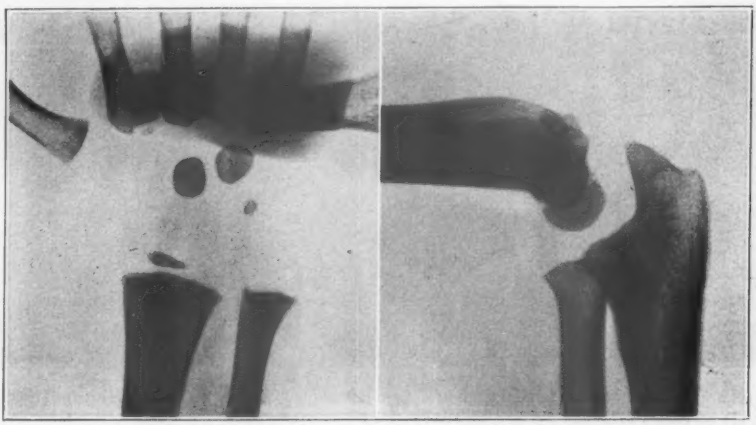

Fig. 1 (Case 1).—Age 7 years; epiphyseal age, approximately 3 years.

The widespread use of iodine in such a form as iodized salt is a great step forward in the prevention of goiter and thyroid deficiency, particularly in children. Such a practice, if continued through several generations, will go far toward the prevention of hypothyroidism and its effects.

In the adult, common symptoms of hypothyroidism include diminished energy and endurance, dryness of the skin and hair, brittleness of the nails, transient numbness of the hands and feet, a tendency to coldness, diminished acuteness of

usually is considered in two forms: (1) congenital hypothyroidism, or cretinism, and (2) juvenile hypothyroidism. In congenital hypothyroidism, or cretinism, the condition usually is more severe, and it having existed before birth, irreparable damage usually has been done, so that even the most energetic treatment has limited results. When the disease arises during childhood, it varies from mild to very severe forms.

The typical cretin is overweight at birth and may nurse poorly and be relatively inactive. The disease generally is

suspected in the first year of life because of a normal increase in weight but not in stature. The face looks puffy and sallow and the tongue is large and may protrude. Goiter is not uncommon. The abdomen is prominent and an umbilical hernia is commonly present. Walking and talking are delayed and the intelligence is markedly impaired. The slow growth is associated with marked retardation of bony development, the centers of ossification appearing late and the epiphyseal lines and fontanels closing late. As in adult hypothyroidism, the blood cholesterol is high.

In such cases, dentition may be delayed markedly and the teeth are often poorly formed and liable to caries. Some of our cases have shown marked dental retardation, but with no signs of caries, apparently because unusual attention was given to the nutrition, a well-balanced diet with large quantities of calcium and vitamins A, D and C having been fed from early life. Exfoliation of the teeth may be late as well, and the eruption of permanent teeth greatly retarded or obstructed. In juvenile hypothyroidism, the disease seldom is so severe. Many of the symptoms mentioned in cretinism may be present, but the intellect may be normal and physical activity in some cases not noticeably impaired. In many instances, the disease is diagnosed because the parents have noticed that the child is not growing at a normal rate or that dentition has been delayed or the deciduous teeth are lost late.

In some of the mildest cases recognizable with certainty and which have come under our care, the presenting symptom has been irregular alinement of the teeth or late dentition. In such instances as this, the family dentist or the orthodontist is likely to be the first to have the opportunity of recognizing the possible presence of thyroid deficiency. It is in instances of this kind that a study of epiphyseal development and of blood cholesterol may be of great value in arriving at the diagnosis. The determination of the basal metabolic rate in children under 8 or 9 years of age is likely to be undependable. To make a correct diagnosis is a matter of practical importance since it is to be expected that the use of orthodontic appliances, no matter how skilful, could not assure so satisfactory a result alone as when used in conjunction with a correction of the metabolic defect. In addition, thyroid feeding results in complete normality if sufficient amounts are continued from an early age.

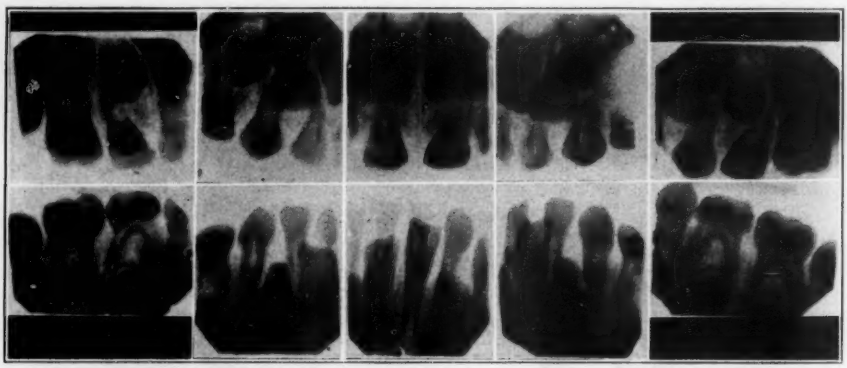

Fig. 2 (Case 1).—Age 7 years; dental age between 5 and 6 years; spacing and occlusion normal; no caries present. No permanent teeth have erupted.

The following cases are presented as examples of cretinism and childhood hypothyroidism of moderate severity and of mild degree.

REPORT OF CASES

CASE 1.—*Cretinism.*—A girl, Italian, aged 7 years, born at Akron, Ohio, walked at 3 years and obviously was mentally retarded. She began to talk at 4 years of age. Speech was slow and indistinct and response to questions very slow. The face was pale and puffy. There was no goiter. The abdomen was prominent, but there was no umbilical hernia. The skin tended to be dry and the hair rather coarse. The height was

Fig. 3 (Case 2).—Juvenile hypothyroidism; age, 9 years and 3 months; epiphyseal age, between 3½ and 4 years.

40 inches, the average (normal) for that age being 50 inches. The epiphyseal age was approximately 3 years. (Fig. 1.) The blood cholesterol was 214 mg. per hundred cubic centimeters (normal, 150 to 200) and there were 3,610,000 red blood cells, with 63 per cent hemoglobin.

The dental age of this patient approximated 6 years inasmuch as all the deciduous teeth were present and no permanent teeth had erupted. (Fig. 2.) Spacing of the deciduous teeth appeared to be proceeding normally; there was no evidence of caries, and the occlusion was normal. The only dental abnormality of note in this case was retardation of eruption.

CASE 2.—*Childhood hypothyroidism.*—A Jewish girl, aged 9 years and 3 months, height 45.6 inches (normal average 52 inches), the chief complaint being failure to grow, had her first tooth at 6 months. She talked at 1 year and walked at 15 months. When 2 years of age, it was noted that her growth was slow. When examined, she was bright and active and answered questions well. She had made an average record at school. Examination revealed dryness of the skin. The abdomen was prominent. At 8 years of age, the basal metabolic rate was −36 per cent and it was now −21 per cent. The blood cholesterol was 264 mg. per hundred cubic centimeters (normal, 150 to 200).

Fig. 4 (Case 2).—Age 9 years and 3 months; dental age approximately 6 to 7 years; no visible caries.

The epiphyseal age was 3½ to 4 years. (Fig. 3.) The lower central incisors erupted at 8 years. The upper central incisors were not erupted. The dental development had been greatly delayed. (Fig. 4.) The dental age was approximately 6 to 7 years.

CASE 3.—*Juvenile hypothyroidism.*—A boy, aged 8½ years, height 46 inches (average normal, 50.1 inches), the chief complaint being failure to grow normally, was active and energetic. The skin was dry and the abdomen prominent. The basal metabolic rate was −9 per cent. The blood cholesterol was 344 mg. per hundred cubic centimeters (fasting). The epiphyseal age was 3 years; dental age, approximately 3½ to 4 years. There

was marked underdevelopment of the dental arches. The first permanent molars were in the process of eruption. There was marked caries of the second deciduous molars and some caries of the erupting molars, due to developmental defects.

CASE 4.—*Juvenile hypothyroidism, mild.*—A girl, aged 11, when first examined in 1934 was 53.7 inches tall, (normal average, 53.4 inches). The weight was 89 pounds (normal, 69 pounds). A diffuse goiter was present. In the preceding months, the patient had become inactive and irritable and wept readily. The bone age was slightly retarded, no pisiform bone being present. The basal metabolic rate was —18 per cent and —21 per cent. In July 1934, the upper lateral incisor teeth had been partially erupted for two years. Because of the low basal metabolic rate and retarded bone age, desiccated thyroid was given in doses of three-quarters grain to 1½ grains per day. After three months of therapy, in October 1934, the teeth were completely erupted and were in normal alinement. The permanent teeth were well formed. Small carious areas were frequent.

Fig. 5 (Case 6).—Pituitary dwarfism; age, 23 years; primary amenorrhea; ovarian deficiency evidenced by sexual infantilism; height, 58 inches; skull changes typical of pituitary dwarfism; dental arches small, necessitating removal of lower first molars; teeth well formed but small; some caries; anomalous roots of lower second bicuspids and third molars.

HYPERTHYROIDISM

Hyperthyroidism in childhood may take on all the features of the disease in adult life. The condition is uncommon. As might be expected, overproduction of thyroid hormone has a result the reverse of a deficiency as long as the disease is compatible with a degree of health that permits growth. The skeleton grows more rapidly and matures more rapidly than normal and the teeth appear before the normal time. One similarity in effect of hypothyroidism and hyperthyroidism exists, a tendency to caries. In hypothyroidism, this is the result of a lack of ability of the tissues to utilize available nutriment; whereas, in hyperthyroidism, the bodily demand for elements of nutrition is increased and there is in addition an abnormally rapid excretion of calcium from the body.

The following is an example of childhood hyperthyroidism.

CASE 5.—*Juvenile hyperthyroidism.*—A girl, aged 4½, first seen in October 1934, was hyperactive and extremely irritable. The pulse rate was 130 per minute. The child had a diffuse goiter and pronounced exophthalmos. In December 1934, the basal metabolic rate was plus 32 per cent. Thyroidectomy was performed in December 1934, and, because of recurrence, a second

operation was performed in April 1935.

In May 1935, when the patient was 4 years and 11 months old, the first permanent molars were beginning to erupt and the lower permanent central incisors were erupting. The deciduous teeth were separating normally, but marked caries was present.

In August 1940, at the age of 10 years and 2 months, the epiphyseal age was 13 years. There were no remaining deciduous teeth. The second permanent molars were ready to erupt. These teeth and the third molars were the only ones that remained unerupted. The teeth were well formed, with no evidence of caries.

PARATHYROID DEFICIENCY IN CHILDHOOD

It has been well demonstrated that experimental parathyroid deficiency in animals during the period of dental formation will result in pronounced hypoplasia of the dentin and enamel.[1] There is a considerable parallelism between such effects as these and those of vitamin D deficiency and rickets in the human being. True parathyroid deficiency in the human being during infancy and childhood is so rarely encountered as to render its discussion here unwarranted.

Fig. 6 (Case 7).—Cast demonstrating crowding of teeth and underdevelopment of dental arches, especially lower, with abnormal bite and occlusion.

One of the many causes of dwarfism is a deficiency in hormone production by the anterior lobe of the pituitary gland. In cases of dwarfism in which growth is impaired and there is sexual infantilism, the condition is known as Lorain-Lévi dwarfism. Hypothyroidism may exist as an integral part of such a condition. In this state, one encounters striking deviation from the normal bone formation. In addition to shortness in stature, the bones are delicate in structure and narrow, with thin cortices. The skull shows the most interesting changes. Here, the development of the facial bones is especially defective. The vault of the skull approaches normal size, but the inner and outer tables are thin and close together, the diploe being scant. The sinuses are poorly developed and lack pneumatization, so that the facial structures are crowded together. The dental arches are small. At times, the mandible is comparatively smaller than the maxillae, while in some the face is so small that there is a relative prognathism. Such changes as these have been studied especially by Mortimer.[2] In rats, after hypophysectomy, he observed that the dental eruption and growth were markedly delayed, the tooth outline was deformed and the pulp cavities were largely obliterated.

Schour and Van Dyke,[3] in studying the molar teeth in hypophysectomized rats, observed retarded eruption and hypoplasia of the enamel and dentin. Schour also mentioned a hypercalcification of the alveolar bone in animals with a long postoperative life. A similar bony sclerosis throughout the skulls of patients with long-standing pituitary disease, previously emphasized by Mortimer *et al.*, more recently has been corroborated by Goldzieher[4] in a study of 500 cases of pituitary disease.

The following cases are examples of pituitary dwarfism.

Case 6.—*Pituitary dwarfism.*—A woman,

aged 23, presented a typical case of dwarfism of the Lorain-Lévi type. Her height is 58 inches, weight 108 pounds. She had never menstruated. The breasts were small and underdeveloped. There was scant pubic hair, but no axillary hair. The vagina and uterus were infantile.

Roentgen examination of the sella turcica afforded no evidence of pituitary tumor. The visual fields were normal. On two assays, the urinary estrogens were two and three units, respectively, the normal level being above thirty units. This confirms the presence of hypo-ovarianism, so obvious clinically. The basal metabolic rate was —2 per cent and the blood cholesterol 164 mg. per hundred cubic centimeters, so that apparently no concomitant hypothyroidism existed.

The skull showed changes typical of pituitary deficiency. The dental arches were small, which had necessitated the removal of the upper third molars and lower first molars. The teeth were well formed, but somewhat smaller than normal. Some caries was present. The alveolar bone and gums were normal. (Fig. 5.)

CASE 7. — *Pituitary dwarfism.* — A boy, aged 16, height 51 inches (normal 66.8), when examined in August 1937 had an obvious hypogonadism and right cryptorchidism. The basal metabolic rate was —8 per cent. The bone age was approximately 9½ years. At that age, only nineteen permanent teeth had erupted, the normal being twenty-eight. The teeth were large and well formed, but the dental arches were small. There were a few small pits on the occlusal surfaces in the posterior region. The mucosa and gums were normal. The second bicuspids were then in the process of root formation.

In April 1939, at the age of 18, the height was 52.25 inches. In October 1939, the height was 53 inches, as compared with an average normal of 68.2 inches. The basal metabolism was —9 per cent and blood cholesterol 263 mg. per hundred cubic centimeters.

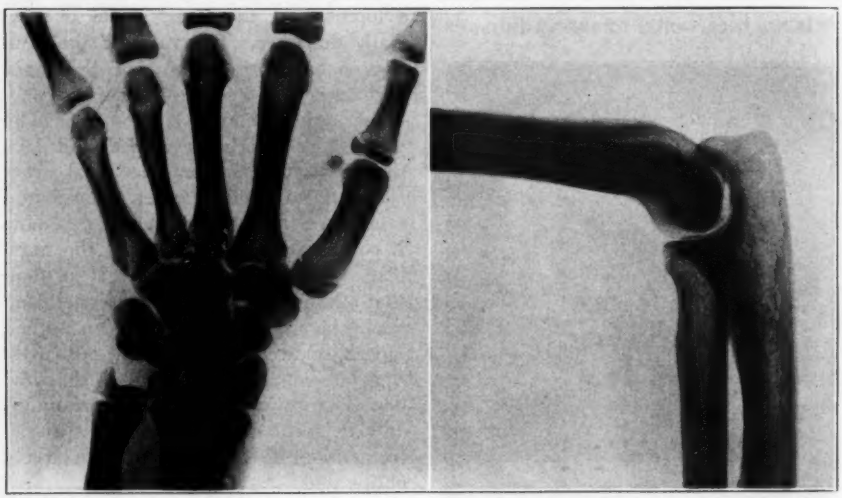

Fig. 7 (Case 9).—Juvenile adrenogenital syndrome; age, 6 years; epiphyseal age approximately 14 years, paralleling sexual age.

By February 1940, the height had increased to 53.5 inches, a growth of approximately 1.5 inches in a year. Between February and August 1940, the patient received methyl testosterone orally and his height increased to 55.7 inches, a growth of approximately 4.5 inches in a year, or three times the preceding rate of growth. The increase in sexual age was obvious.

In August 1940, the bone age was approximately 12½ years. The teeth were still badly

crowded, with resultant malocclusion. The dental age exceeded 12 years as judged by the development of the upper third molars. The teeth themselves were well formed and showed no caries. The cast shown indicates the small size of the lower jaw. (Fig. 6.) The rapid growth being produced in the skeleton under the present treatment gives decided hope of decreasing the dental crowding and aiding materially in correction of the malocclusion.

FROEHLICH'S SYNDROME

In adiposogenital dystrophia, the outstanding clinical signs are obesity and aplastic genitalia. The condition is the result of a lesion of the pituitary and hypothalamus. Here, the teeth are notably well formed and excellent in every way.

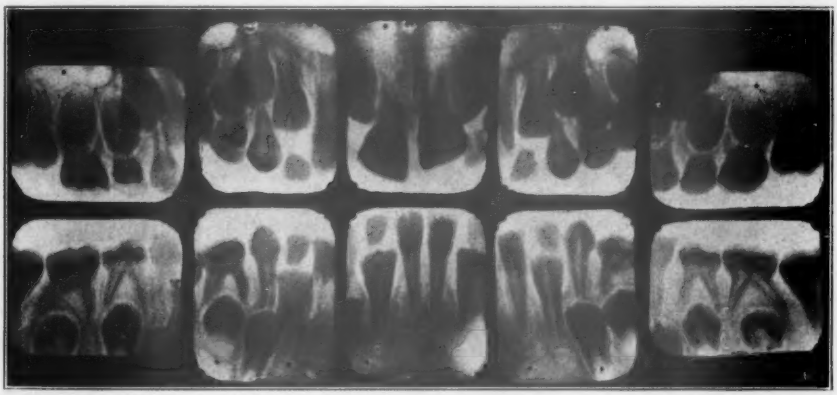

Fig. 8 (Case 9).—Age, 6 years; height, 55 inches (normal average, 46 inches); sexual age, advanced to approximately normal for 14 to 15 years, which parallels epiphyseal age; dental age paralleling chronologic age; no carious teeth.

PUBERTAS PRAECOX AND JUVENILE ADRENOGENITAL SYNDROME

Tumors of the pineal gland, testicle or ovary causing pubertas praecox are extremely rare. Pubertas praecox associated with adrenal tumor and appearing at times as part of the juvenile adrenogenital syndrome is less rare, but cases in which the condition is presumed to be due to functional hyperactivity of the adrenal cortex are not very uncommon.

An outstanding feature in nearly all such cases is the abnormally early appearance of signs of puberty. In some of those related to adrenal tumors, other features of adrenal disease such as obesity, polycythemia and alteration in sodium and potassium levels in the blood may be seen. In some, there is marked muscle hypertrophy. In some, a very high titer of male hormone has been found in the urine.

It does not seem remarkable that, in some cases of this type, the marked acceleration of bone growth and advanced epiphyseal maturity might be associated with precocious dental development; but it does seem remarkable that the instances which have come to our attention show extreme changes in the skeleton with markedly advanced epiphyseal age, yet the dental development parallels the chronologic age.

The following cases are examples of pubertas praecox and the adrenogenital syndrome in children.

CASE 8. — *Adrenogenital syndrome with pubertas praecox.*—A boy, first seen when 4 years old, and now 6, was 55.7 inches tall (normal average 46 inches) and had the

appearance of a boy much older, his sexual maturity belying both his size and his years. His voice was gruff and low and he had acne of the puberal type. Axillary and pubic hair were abundant. The penis was normal in size for an adult, the scrotum was developed and the testes were the size of peas. Roentgen examination of the adrenal area after perirenal air injection revealed a round tumor mass in the region of the left adrenal gland. Urinary androgens (male hormone) reached 140 units per day (normal for adults, 18 to 80 units). The bone age was approximately 14 years. The dental age, on the other hand, corresponded to the chronologic age. The lower lateral incisors had erupted and the upper central incisors were beginning to erupt. The first permanent molars had erupted and were in normal alinement. The lower deciduous central incisors were in place and the permanent lower central incisors were missing on the roentgenogram (anodontia). The deciduous left molars and deciduous right second molars were present. There was no apparent abnormality of the permanent teeth.

CASE 9.—*Pubertas praecox.*—A boy, aged 6 years, brought in because of too rapid development, was 55 inches in height (normal average, 46 inches). He had facial acne and axillary and pubic hair was present. The penis was enlarged to a size comparable to normal for the age of 14 years. Hypospadias was present. The scrotum was poorly developed and there was bilateral cryptorchidism. The skeletal age was approximately 14 years. (Fig. 7.) The dental age, as in Case 8, approximated the chronologic age; namely, 6 years. The lower first permanent molars had erupted and the upper molars appeared ready to do so. The deciduous lateral incisors all showed root absorption, with the succeeding permanent teeth ready to erupt. The permanent lower central incisors and upper right central incisors had erupted. One proximal carious area was noted on the lower deciduous molar. The deciduous teeth were normal in form, size and alinement. Occlusion was normal. (Fig. 8.)

Fig. 9 (Case 10).—Acromegaly. The mandible and maxilla had enlarged in all diameters, the teeth separating uniformly. The gums were hypertrophied and soft and there was incipient pocket formation. There was slight uniform alveolar resorption. There were no carious lesions of the teeth.

ENDOCRINE DENTAL RELATIONSHIPS IN THE ADULT

In the adult, the teeth may be damaged by endocrine disorders which change the structure of the jaw, as in acromegaly or parathyroid disease, or by disease of the soft tissues, as in diabetes mellitus.

Thyroid disease in the adult, pituitary

or gonadal deficiency, adrenal deficiency or tumor causes no notable changes in the teeth, jaws or gums. Pregnancy still is considered by many to cause metabolic defects affecting the teeth, but this is probably not true, unless such effects are a part of changes of the chemical conditions in the mouth. Such careful studies as those of Ziskin[5] would appear to refute such statements, since, after a study of 324 pregnant women, he concluded that pregnancy *per se* does not increase dental caries, but actually tends to prevent it.

PARATHYROID DISEASE IN THE ADULT

In parathyroid tetany in the adult, the serum calcium level falls as a result of a deficiency of parathyroid hormone. The blood phosphorus rises and there is an increase in neuromuscular excitability, typified by spastic contractions of the muscles, especially of the hands and feet. In chronic cases, trophic changes, such as cataract or ridging or loss of the nails, occur. In some cases, the teeth become extremely loose so that they can be moved about freely. Is this looseness due to trophic disturbances affecting the health of the peridental membranes? Whatever may be the cause, administration of large doses of calcium, such as 1 or 2 teaspoonfuls of calcium lactate three times a day, will be followed by fixation of the teeth within a few days. The structure of the tooth itself remains unaffected.

In hyperparathyroidism[6] such as is seen in cases of parathyroid tumor, the chief changes are an increase in serum calcium to above 11 mg. per hundred cubic centimeters and usually phosphorus levels of 2.5 or less. The excess of calcium in the blood is drawn from the skeleton, which becomes weak and brittle, and may result in the formation of multiple cysts of the jaws, which must not be confused with local cysts of other origin. At times, the jaw may become so decalcified that the teeth fall out. It is of extraordinary interest that, under these conditions, the teeth do not become decalcified. Here, Nature has arranged one of the best possible demonstrations of the fact that the teeth of the adult are free from decalcifying effects that can harm the skeleton.

DIABETES MELLITUS

In diabetes mellitus, the gums are particularly subject to infection. This is part of the generally lowered resistance. Here, careful cooperation between the internist and the dentist is essential, since good care in the diabetic state includes freedom from infection, and, conversely, the health of the gums requires adequate control of the metabolic disorder. Extraction of a tooth may, in some cases, be sufficient to make diabetes uncontrollable or even to precipitate acute acidosis. In our practice, in diabetes, when dental extraction is necessary, we prefer to keep the patient in the hospital for a few days. There, the diet may be modified, if soft foods are needed, while dietary control is maintained. Also, urine and blood tests can be made as frequently as is required, and thus complete control of the diabetic condition is insured.

PITUITARY HYPERACTIVITY IN THE ADULT

The most striking changes in the jaws and teeth encountered in adulthood as the result of endocrine disease are found in gigantism and acromegaly, the latter condition resulting from hyperactivity of the anterior lobe of the pituitary gland, including hypersecretion of the growth hormone. If the disease begins before growth has ceased, gigantism results and may merge with acromegaly.

In this disease, the bones and soft tissues grow, especially those of the extremities and the head. The skull is affected in a manner which is the antithesis of that seen in dwarfism. The vault of the skull grows thick, the tables being increased in thickness and separated by

an enlarged diploe. The sinuses become enlarged and hyperaerated, the size of the face increasing. The dental arches grow, the diastema increasing. The mandible increases in length, with resultant malocclusion, the teeth being subjected to excess trauma. Finally, because the gums are poorly protected, there is a tendency to pocket formation and peridental infection.

The following cases illustrate some of the outstanding features of this disease.

CASE 10.—*Acromegaly.*—A white woman, aged 32, height 64 inches, and weight 154 pounds, complained of increasing enlargement of the face, hands and feet over a period of ten years, and of progressive weakness.

Roentgen examination of the skull revealed signs typical of acromegaly. The mandible appeared enlarged in all diameters, separation of the teeth resulting. The tongue was enlarged, with pronounced hypertrophy of the papillae. The gums were hypertrophied, soft and pale. There was early pocket formation, but no periapical disease. Hypercementosis was present in the second upper bicuspids. There was no alveolar resorption. All remaining teeth were sound. (Fig. 9.)

CASE 11.—*Acromegaly.*—A man, aged 47, who had had progressive growth of the jaw with increasing spacing of the teeth for nine or ten years, in the past five years had had noticeable enlargement of the hands and head. There was a substernal goiter with hyperthyroidism. The basal metabolic rates on two occasions averaged +32 and +31 per cent. Urinary androgens were high, being 93 international units in twenty-four hours. Arterial hypertension was present. Roentgen examination showed erosion of the sella turcica caused by a pituitary tumor.

The mandible was markedly prognathic. The angle of the mandible with the ramus had changed from the normal until they formed an arc. The width of the mandible had altered little. The alveolar bone appeared unusually dense. There was rather advanced macroglossia. There was a marked diastema. Some teeth showed peridental proliferation, due probably to trauma, and there were incipient pockets, but no suppuration and no caries.

SUMMARY

The endocrine disorder producing the commonest and most extensive dental effects is thyroid deficiency. It operates chiefly from prenatal life until tooth formation is complete.

The endocrine disease producing the most marked changes in the jaws is pituitary disease, which may result in dwarfism in childhood or gigantism or acromegaly in adult life.

The jaws may be markedly demineralized in instances of parathyroid hyperactivity. The investing soft tissues are the primary site of oral disease in diabetes mellitus.

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SYSTEMIC BACKGROUND OF PARADENTOSIS

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THE search for the etiologic factors of paradentosis has during the last few years received renewed stimulation and encouragement through the activities of the International Association for Paradentosis Research (ARPA). However, it would seem that the knowledge which has been gained from the many costly and time-consuming laboratory and clinical investigations is leading to some doubt as to the correctness of present scientific approach to the problem because of the many contradictory results and the failure of therapeutic measures when these results are applied clinically.

For this reason, one can hardly blame our profession for exhibiting a certain skepticism and hesitancy in accepting newer findings and concepts which deal with the causative factors of this disease. This reserve has manifested itself lately in a reluctance to adopt a newer and possibly better nomenclature.

The substitution of the term "paradentosis" for "pyorrhea alveolaris" was proposed and adopted at the Eighth International Dental Congress in Paris, August 1931. Almost nine years have elapsed since then, but little use has been made of this new term in American literature, even though it is generally admitted that most designations suggested for this disease are inadequate. The old terms "pyorrhea" and "periodontoclasia" seem to be rooted so deeply in the minds of the present dental generation that it appears almost impossible to banish them from the vocabulary.

It is frequently said that the more important aspect of the "pyorrhea" problem, from the point of view of the operator and the patient, is that which has for its purpose relief; i.e., the therapeutic aspect. However, therapeutic measures can be successful only if the causative factor or factors are definitely understood. Experience has shown that progress in certain phases of dental science is more readily recognized if the results of discoveries or developments along practical phases can be judged by their financial reflection. Unfortunately, developments in the field of paradentosis have been lacking and have not led as yet to recognition of the broad understanding required in the treatment of this disease. This situation is expressed also in the rather inadequate paradentic curricula of most of our larger institutions. Only a comparatively few dental practitioners are interested in the deeper study of this disease or in elevating its treatment to one of the most important fields of dental therapy, to restore to normal health damaged tissues of epithelial and connective tissue origin, generally designated today as the "paradentium."

One of the latest developments for a better understanding of the paradentosis problem was the introduction of a clinical classification of all diseases of the paradentium designated as paradentopathies, which Weski[1] presented at the Ninth International Dental Congress in Vienna (1936). (Table 1.) It seems to be most suitable for practical purposes and includes three subdivisions:

Read before the Section on Periodontia at the Seventy-Sixth Annual Midwinter Meeting of the Chicago Dental Society, Chicago, Ill., February 14, 1940.

From the George Williams Hooper Foundation for Medical Research and the College of Dentistry, University of California.

1. A group of conditions that are of a neoplastic nature and have been designated by Balogh as paradentoma. The epulis may be considered representative of a localized form (Fig. 1), while elephantiasis of the gingivae represents the generalized form (Fig. 2).

2. The various types of gingivitis or marginal paradentitis.

The condition in a Japanese patient 16 years of age (Figs. 3 and 4) could be traced to heavy marginal deposits throughout the mouth, rough margins of a dowel crown on the right upper central incisor and a deficient silicate filling on the mesial side of the left upper central incisor. After thorough subgingival curettage and replacement of ill-fitting fillings, the condition was considered cured after about six weeks (Fig. 5).

TABLE 1.—CLASSIFICATION OF DISEASES OF THE PARADENTIUM

PARADENTOMA		PARADENTITIS		PARADENTOSIS	
		alias			
Localized Form:	Generalized Form:	Gingivitis		Partial-atrophic:	Total-atrophic:
Epulis	Elephantiasis gingivae	Hyper-trophic	simple and ulcerative	True form of Paradentosis	Alveolar-Atrophy

TABLE 2.—FREQUENCY OF SYSTEMIC DISTURBANCES IN EIGHTY CASES OF DYSTROPHIC TYPE OF PARADENTOSIS

		NO. OF CASES	PERCENT
I	HYPOTHYROIDISM	22	27.50
II	HYPOTHYROIDISM PLUS OTHER ENDOCRINE DISTURBANCES	21	26.25
	TOTAL OF I AND II	43	53.75
III	ENDOCRINE DISTURBANCES WITHOUT HYPOTHYROIDISM	24	30.00
	TOTAL OF I, II AND III	67	83.75
IV	SYSTEMIC DISTURBANCES OTHER THAN ENDOCRINE UNBALANCE	10	12.50
	TOTAL OF I, II, III AND IV	77	96.25
V	NEGATIVE PHYSICAL EXAMINATION	3	3.75

The hypertrophic form (Figs. 3 and 4) is well known to be frequently the result of chronic irritation (calculus, overhanging fillings or crown margins, etc.). In contrast to the paradentoma (Figs. 1 and 2), it must be remembered that this hypertrophy is reversible and can be successfully treated by removing the cause or causes, which, as stated, are frequently of exogenous origin.

The ulcerative form of gingivitis or paradentitis, demonstrated in Figure 6, is known to the profession as trench mouth, Vincent's infection, etc. Its successful treatment depends, to a large extent, on an understanding of the cause. The condition may be of local origin in some instances and of an endogenous

type, as, for instance, in agranulocytosis. The possibility of a dual existence of local as well as systemic factors must always be considered.

3. (a) Partial atrophy (Fig. 7), which is characterized by irregular bone and soft tissue recession and which constitutes the majority of the cases of paradentosis seen in daily practice, and (b) total atrophy (Fig. 8) in the typical forms of presenile and senile atrophy, which are characterized by simultaneous recession of gum tissue and bone structure without obvious inflammation or pocket formation.

From an etiologic point of view, the historical development of dentistry and the pronounced prosthetic inclination of practitioners may be responsible, in part at least, for the rather slow progress in

Fig. 1.—Epulis on buccal side of upper right first molar, due to chronic irritation by ill-fitting crown.

understanding of the causative factors of paradental diseases. However, it must be admitted that the many theories as to the etiology of paradentosis, which, according to Blessing, number more than 350, have not helped the practitioner to clarify his viewpoint with regard to a systematic local and general therapy.

The well-known classification of investigators by Arkövy[2,3] into "localists," "constitutionalists" and "fusionists" still appears valid. The localists maintain the theory that primarily exogenous conditions irritate the gingival margin; for instance, calculus, overhanging fillings, crowns or other foreign bodies, i.e., bristles, fish bones, etc., which produce an inflammation of the gum tissue. They believe that this marginal inflammation progresses finally into the deeper parts of the paradentium, causing resorption of the osseous structure and, ultimately, loss of the teeth. The constitutionalists believe that bone resorption, pocket formation, tooth loosening and migration can occur without inflammatory processes and originate on the basis of endogenous, i.e., internal or general systemic, conditions. The so-called fusionists believe that both conditions must be present.

There can hardly be any doubt in the mind of the profession that both local

Fig. 2.—Elephantiasis gingivae in patient 14 years of age. Biopsy of the gingivae revealed fibromatosis. (Courtesy of H. F Gillard.)

and constitutional endogenous conditions influence the health of paradental structure. I may call to mind the typical pregnancy gingivitis (Fig. 9), on the one side, as the prototype of the endogenous form, while gingivitis the result of inactivity, as demonstrated in Figure 10, represents the type of exogenous origin. The question, of course, arises as to how often an endogenous influence must be expected, even as far as percentage is concerned, in routine cases, so that we may not become too hopeful of early

establishment of the etiologic factors of the disease. In general, it can be said that, of course, the percentage of systemic and local etiologic factors must vary with each investigator and clientele. For this reason, we have not arrived at a satisfactory answer to the question whether paradentosis must always be considered the result of localized exogenous conditions; whether definite constitutional types with specific organic dispositions must exist to bring about a paradentopathy, and, finally, if the latter should always be found, whether this endogenous component is the result of certain general systemic diseases.

An attempt will be made to outline some fundamental observations which have been made during the last few years in various parts of the world and which seem to indicate that many diseases of the paradentium are of endogenous origin.

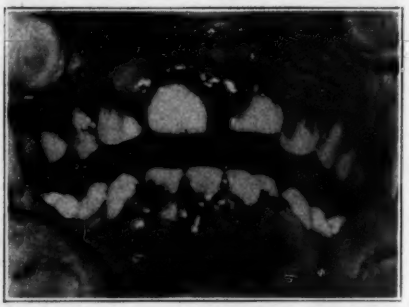

Fig. 3.—Hypertrophic gingivitis due to chronic marginal irritation. (Courtesy of R. W. Rule.)

In order to clarify our position in this field, it appears necessary first to consider two outstanding problems:

1. Which tissues of the paradentium can be influenced by a change in systemic conditions?

2. Which systemic disorders have been definitely shown to affect a part or parts of the paradentium, and do they produce specific types of paradentosis of an accepted classification?

In considering the first question, it must be remembered that connective tissue, as a derivative of the mesenchyme, is the main carrier of the individual hereditary constitution, and all tissue reactions that determine the constitution of an individual are controlled more or less by the vegetative nervous system. Now, it is interesting to see that the connective tissue plays an instrumental part in the successful execution of all these functional processes. It is furthermore known that wear, senility or involution processes may lead to increased hardness, changes in diffusibility, decrease in water retention and colloid protection against precipitation. On the other hand, an inherited inferiority may be without any influence on its function unless harmful endogenous or exogenous influences are added in earlier years. Later on, senile changes may bring to light such an inferiority as can greatly disturb the biologic equilibrium, expressing itself in a predominant tissue atrophy as seen, for instance, in the senile and presenile atrophy.

Fig. 4.—Hypertrophic gingivitis due to chronic marginal irritation.

According to the constitutional disposition, a differentiation (Stärke)[4] can be made among (1) a hypoplastic-hypo-

tonic mesenchymal type; (2) a hyperplastic-hypertonic mesenchymal type, and (3) a type that lies between the two former. The hypotonic type is characterized by an anatomically loose, wide mesh of all mesenchymal tissue, which has a decreased functional capacity and diffusibility and shows a slow reaction to stimulation. The hypertonic type, on the contrary, has a fine tissue texture with increased functional capacity and rapid response to stimulation. However, it becomes easily fatigued, with a tendency to tissue hyperplasia.

It is believed that these two fundamentally different constitutional types of tissue forms reflect the two main types of paradentosis (Stärke), one with a tendency to inferior functional performance,

Fig. 5.—Oral condition of patient of Figures 3 and 4, following subgingival curettage and replacement of ill-fitting fillings and crowns.

atrophy and degeneration and the other with a rapid response in the form of inflammatory processes, or regeneration of bone and cementum. According to several authors, it appears probable that this functional disposition of the tissue determines, to a large extent, whether paradental disease shall tend more toward a destructive or toward an inflammatory form. It is believed, for instance, that the allergic-arthritic diathesis with a typical inflammatory component is the expression of the hypermesenchymal type.[31]

The reticulo-endothelial system[5] is also derived from mesenchymal tissue and its functional capacity is determined by its constitutional disposition. We all know, for instance, that the response of the circulatory system to chemical and nervous stimulation is of the greatest importance for the transport of nutritive material and the removal of the end-products of cell metabolism, and any vascular disturbance must have definite manifestations. Many attempts have been made to use capillary microscopy as a method of investigating the capillaries of the nail bed, lips and gum tissue, to determine whether a difference exists between healthy persons and patients with paradentopathies. Irregularities of form and width of capillary loops have been reported in a number of paradental diseases. However, it is believed that they

Fig. 6.—Ulcerative gingivitis (paradentitis).

are not specific for paradentosis. In general, hypertonic and atonic types can be recognized which are vasomotor constitutional types and which manifest themselves clinically as dermographism, acrocyanosis, coldness of the extremities, angioneurotic edema, etc. Neurotrophic conditions, the presence of various hormones, in particular adrenalin (well known in dentistry), the electrolytic composition of tissues and blood, as well as amines, cholesterol, iodine, etc., have a decided influence on capillary tone. It is, therefore, only too obvious that not only localized circulatory disturbances can affect the health of the paradental structure, but generalized circulatory disturbances as well. For this reason, it is not surprising that paradentosis develops, to-

gether with circulatory insufficiency, in patients suffering from heart, lung and kidney disorders, etc. (Stärke.)

The vegetative nervous system, together with the hormones and electrolytes, should be mentioned in this connection. They are so closely interrelated that it is sometimes impossible to recognize which of these three systems was affected first. The two main parts of the vegetative nervous system, the sympathicus and parasympathicus, or vagus, are known to have an antagonistic effect on the various organs. A possible relationship between their function and paradental structure was first reported by Citron.[6, 7, 8] He found that more than 80 per cent of all paradentosis cases were of a vagotonic type; which seems to be of great significance in the interpretation of etiologic factors. The increased tonus of the entire intestinal tract and the tetany and spasmophilia of children are symptoms of increased vagus sensitivity. Diseases of the thyroid (myxedema, Basedow's) and diseases of the hypophysis (acromegaly) and other endocrine organs can lead to trophic disturbances. Finally, pure psychic disturbances may result in anatomic changes of the paradentium over the vegetative nervous system, if we remember the various psychic effects on peripheral tissue, as, for instance, blushing because of shame, growing pale because of anger and perspiring because of fear, or the sudden change of hair color to gray following a nervous shock. For the same reason, certain trophoneuroses, hysteria, epilepsy and insanity can affect paradental structure. The high frequency of paradental lesions in inmates of insane asylums is only too familiar to us. Finally, van Cleef[9] called attention to the fact that paradental disturbances usually become aggravated as the result of sorrow or grief and that they frequently improve after a period of relaxation and restored mental condition.

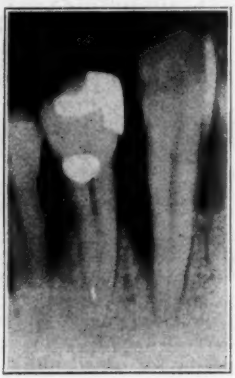

Fig. 7.—Vertical atrophy; deep pocket formation; loss of contact point.

During the last two decades, great hopes have been placed in the endocrine glands as possibly related through their hyperfunctions and hypofunctions to certain forms of paradentosis. However, the fact that all these hormone-producing organs are closely interrelated has led in the past to most questionable deductions. The secretory products of the thyroid, pancreas, hypophysis, gonads and parathyroids have been mentioned most frequently. However, to draw far-reaching conclusions from observations of only a few clinical cases appears most questionable, and I must agree with Lisser and Shepardson[10] that "laboratory tests are only an aid to clinical diagnosis" and that "they cannot be substituted for painstaking history and thorough physi-

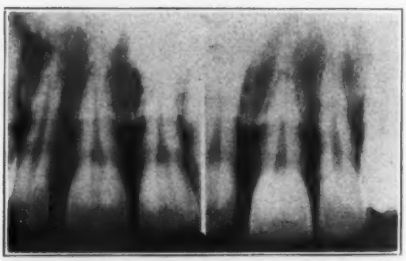

Fig. 8.—Horizontal atrophy of alveolar crest with simultaneous recession of gum tissue; no pocket formation.

cal examination in establishing the existence of any disease." For this reason, some of the earlier publications of results of cholesterol, bilirubin, calcium, potassium and sugar determinations on the blood, as well as investigations with Abderhalden's interferometric methods, etc., remain primarily of theoretical interest.

On the other hand, Citron[11, 12] found, in eighty-seven cases of paradentosis, a dysfunction of the thyroid, parathyroids, ovaries and pituitary gland with a high percentage of abnormal serum calcium values; while Boenheim[13, 14, 15] reported a possible relationship between hyperthyroidism (Basedow) and paradentosis. The frequent clinical observations of the coexistence of hyperfunction of the thyroid gland and paradental disturb-

Fig. 9.—Pregnancy gingivitis.

ances make it highly probable that the increased calcium and phosphorus excretion, the effect of general and especially protein metabolism on the central nervous system and the resulting disharmony with the function of other endocrine glands are etiologically related to paradentosis.

Figure 11 demonstrates the advanced condition of paradentosis in a myxedematous cretin at the age of 17 years. The paradental structures of posterior teeth were similarly involved. Even though there was little decay present, the extraction of all teeth became imperative before the patient was 20 years of age. In physiologic bone age, the case was six years retarded.

Possible relationship between dysfunction of the pancreatic gland and paradentosis has been frequently mentioned. In fact, "paradentosis diabetica" has been considered the prototype of a hormonal disturbance. However, the statistics of the past vary greatly. For instance, Boenheim[16, 17] found no diabetes in 200 cases of paradentosis; Citron[11] one in 100, and Nothman[18, 19] five in fifty cases. Using the reverse procedure, that is examination of a group of diabetic patients for paradentosis, Butz[20] found ten cases of paradentosis in sixty-seven diabetics and concluded that a relationship be-

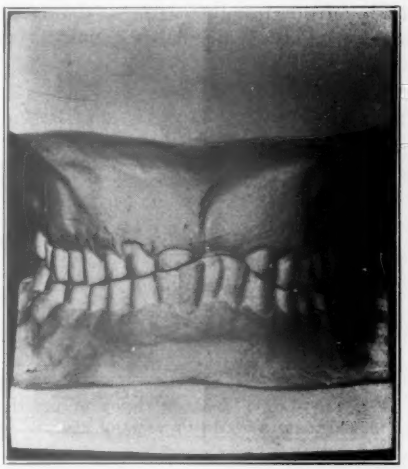

Fig. 10.—Gingivitis as result of inactivity atrophy in lower anterior region.

tween the two conditions does not exist. A higher frequency was noted by Roth,[20] who found thirty patients (58.8 per cent) with paradentosis among fifty-one diabetics. Dimitrova[21] found definite paradental disturbances in fifteen of sixteen diabetic patients. Weichert,[22] as well as Weicksel,[20] emphasized the fact that with favorable metabolic conditions, a definite improvement from local oral treatment could be observed, and that under insulin treatment, inflammatory conditions and

paradentosis sometimes disappeared completely.

It is not possible to consider all former investigations on this problem. An excellent review has just been completed by Rutledge,[23] who also investigated the question of frequency of paradentosis in juvenile types of diabetes. He found by clinical and roentgenographic study that sixteen, i.e. 80 per cent, of twenty diabetic children between the ages of 8 and 19 years, had definite symptoms of gingivitis, marginal vertical or horizontal atrophy of the interdental alveolar bone structure or marginal widening of the peridental membrane space. He concludes, from his observations, that the oral aspect of juvenile diabetes constitutes

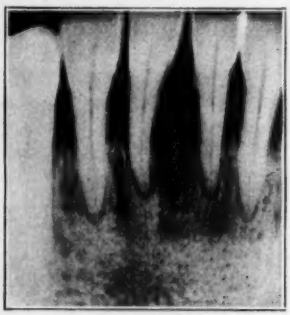

Fig. 11.—Lower anterior region of mouth of myxedematous cretin 17 years of age.

an important and early symptom of this endocrinopathy.

The following case is one of Rutledge's in a young patient who showed definite clinical paradental manifestations at the age of 17 years. At the time of entry to the University of California Hospital, in October 1938, his condition was diagnosed as diabetes mellitus, tuberculosis, xanthomatosis and paradentosis. There was no family history of diabetes. In 1937, the patient noted swelling between the upper right central and lateral incisors, which was operated on surgically, but recurred soon (Figs. 12, 13, 14, 15).

This case of paradentosis, which had reached a very advanced stage at the age of 17 years, must also be considered from another interesting point of view, namely that of xanthomatosis. In 1931, Gescheff[24] reported the presence of lipoids in paradental tissue in cases of diabetes after Berberich[25] had found that, in nearly all cases of diabetes, a hypercholesteremia of blood existed. Gescheff, in the course of his histologic examinations of gum tissue and paradental granulation tissue of diabetic patients, noted in five of six cases round-cell infiltration in the subepithelial connective tissue with an abundance of fatty deposits. He concluded that this fatty infiltration of the inflamed paradental tissue is the result of the diabetic lipemia, which lowers the

Fig. 12.—Paradental conditions of patient, 17 years of age, with diabetes, xanthomatosis and tuberculosis.

resistance and decreases the healing tendency of paradental lesions. According to Gescheff, these anatomic findings seem to explain the predisposition or constitutional tendency to paradentosis.

The diagnosis of xanthomatosis of the case shown in Figures 12-15 was also based on the presence of a large amount of fat in the paradental tissue between the right upper central and lateral incisors, and seems to confirm Gescheff's observations.

In a recent survey made in the Division of Dental Medicine at the University of California, it was found that in eighty cases of the dystrophic type of paraden-

tosis,* a very high percentage of patients were suffering from general systemic disturbances. (Table 2.)

Group I represents twenty-two cases presenting definite clinical symptoms of hypothyroidism without other obvious endocrine involvement. The clinical diagnosis was supported by the differential blood count, basal metabolic rate and cholesterol determination on the blood.

Group II includes pluriglandular disturbances, among which hypothyroidism is represented in each case.

Group III includes other endocrine disturbances without hypothyroidism, as, for instance, diabetes, hypogonadism and pituitary dysfunction.

Group IV includes intestinal disturbances, blood dyscrasias, allergies and mineral and vitamin deficiencies.

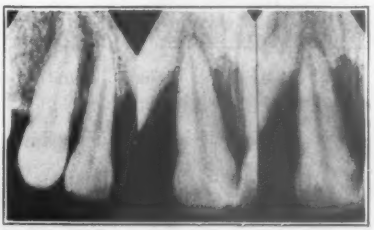

Fig. 13.—Roentgenogram of condition in Figure 12.

Group V includes the three of the eighty cases proved to be completely negative on physical examination.

Emphasis must be placed on the fact that these observations and findings mean solely that a surprisingly large number of systemic disorders (96.25 per cent) are found in coexistence with one specific type of paradentosis, although no deduction can be drawn as yet as to cause and effect. The importance, however, of considering possible dysfunction of the endocrine system in establishing the individual etiology must be stressed, because of its known influence on general metabolism; in particular on protein, carbohydrate and mineral metabolism, on the vegetative nervous system, reticulo-endothelial system, etc., which may leave definite scars in the various parts of the paradentium. We gained the impression that in most of these cases there were no outstanding local factors present, which may mean that if the systemic conditions are capable of causing paradentosis, they can do so in the absence of additional exogenous irritation, which is in contrast to Breuer's findings.[26]

Most recently, Palazzi[27] has called attention to a close relationship between blood anomalies and paradental disorders, which were studied in detail at the University of Pavia. His observations, which were made on a large amount of clinical material, brought out the important fact that nearly all hematologic changes can lead to paradental manifestations. These, however, have a characteristic appearance, which is sometimes fundamentally different from the everyday forms of paradentopathy. He mentions anemia, which is frequently the result of infectious disease, exogenous or endogenous poisoning, operations and roentgen-ray irradiation. It is furthermore well known that nephritis; carcinoma of the intestinal tract, and such poisons as benzene, arsenobenzene, lead and all substances which form methemoglobin, such as potassium chlorate and

Fig. 14.—Paradental condition of patient aged 17, with diabetes, xanthomatosis and tuberculosis.

*"Distrophia diffusa" according to the classification of paradentosis suggested at the VIII International Dental Congress, Paris, 1931.

nitrobenzene, can cause severe blood dyscrasia. Palazzi furthermore mentions pernicious anemia (excepting Biermer's anemia), the anemic forms of syphilis, anemia with macrocytosis and macroplasia and hyperchronic anemia with enlargement of the spleen and poikilocytosis and, finally, aplastic anemia and myelosis. Leukemia and agranulocytosis, purpura and other expressions of the hemorrhagic diathesis, such as scurvy, as well as severe inflammatory conditions of the hematopoietic organs, have been mentioned by this author.

dental condition of a girl aged 14 who had had repeated and almost chronic illness since her first year of life. Medical records showed liver abscess, chronic otitis, left interstitial keratitis, left ventral hernia, Vincent's infection, rickets, gonorrheal ophthalmia, eczematous conjunctivitis and lymphadenitis of the axillary gland. When she was 10 years of age, the patient developed agranulocytosis and ulcerative gingivitis. Severe hemorrhage and progressive recession of the bone structure and gum tissue, accompanied by increasing loosening of all the

Fig. 15.—Paradental condition of patient aged 17, with diabetes, xanthomatosis and tuberculosis.

Clinical observations seem to confirm Palazzi's work, which may be illustrated by three cases. A woman, aged 24, developed a monocytic leukemia (Fig. 16), and died eight weeks after hospitalization. The gum tissue was very edematous and bled on the slightest touch. A few weeks before death, the teeth became increasingly loose and there were profuse hemorrhages.

Fig. 16.—Paradental condition of patient with monocytic leukemia.

A girl (Fig. 17), aged 14 when the diagnosis of idiopathic thrombocytopenic purpura hemorrhagica was made, had had severe hemorrhages of the gum tissue for many years, with great loss of blood during menstruation. Splenectomy was performed, followed by repeated blood transfusion. This condition of blood dyscrasia necessitated thirteen periods of hospitalization. By the time the patient was 26 (1937), she had developed an advanced condition of paradentosis, with deep pocket formation.

Figures 18, 19 and 20 show the para-

teeth for the last four years, were the salient features of the dental history. All therapeutic measures failed to arrest the condition.

Palazzi states that the diagnosis of a blood dyscrasia frequently can be made from oral manifestations. He emphasizes the necessity of internal therapy, which sometimes results in a real metamorphosis of the affected paradentium, while local treatment alone (even though it should not be ignored) has little effect. According to this author, the presence and in-

fluence of general pathogenic conditions on the paradentium, as well as the influence of internal therapy, must be generally accepted.

The recent work of Breuer,[28, 29, 30] who believes that all paradental disturbances, especially the inflammatory conditions, are manifestations of internal disease, requires special attention. He states that they afford important diagnostic criteria for their early detection and recognition because they frequently occur long before other clinical manifestations are apparent. Outstanding among the diseases that he found to be related to paradentosis were all general infectious diseases (in particular, influenza), metabolic disturbances, endocrinopathies, avitaminosis and hypovitaminosis, diseases of the blood-forming organs, allergies and disturbances in liver function and of the intestinal tract. All these diseases, according to Breuer, have their initial symptoms in the oral cavity. He denies that any of these internal disturbances alone are capable of causing paradentosis and states that paradentosis manifests itself only if malocclusion, abnormal articulation or unfavorable contact between the individual teeth is present in addition to the internal disturbance; and again, if all these conditions are "normal," no paradentosis occurs in spite of the general disorder. He believes that this explains the great differences reported in the frequency of paradentosis in diabetes, etc.

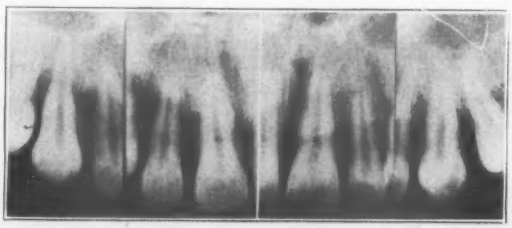

Fig. 17.—Marginal atrophy accompanying thrombocytopenic purpura.

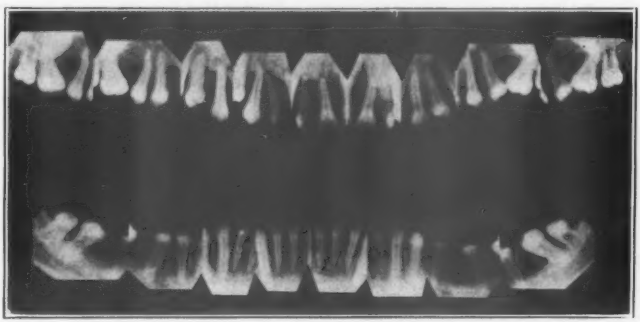

Fig. 18.—Advanced paradentosis in patient, 14 years of age, with agranulocytosis.

In other words, an increase in blood sugar level, deviations from normal values for cholesterol, potassium, calcium, bilirubin, uric acid, etc., i.e., a disturbance of general metabolism, may cause marginal inflammatory conditions of the paradentium (gingivitis), but not paradentosis, unless abnormal anatomic or functional conditions are also coexistent.

Breuer furthermore found that no special types of paradentosis (classified according to the clinical types agreed upon at the International Dental Congress in Paris, 1931) were more common than others. This is in agreement with our observations, which answer the last part of the second question as to whether any systemic disease produces a specific type of paradentosis of an accepted classification.

In summarizing, it can be said that there is no general uniform cause of paradentosis. The pathogenesis of paradentosis is different in nearly every case and the disease can develop as the result of certain exogenous conditions as well as internal ones.

Fig. 19.—Advanced paradentosis in patient, 14 years of age, with agranulocytosis.

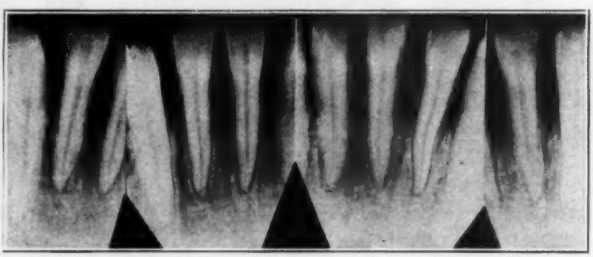

Fig. 20.—Advanced paradentosis in patient, 14 years of age, with agranulocytosis.

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SOME OF THE RESPONSIBILITIES OF THE ORTHODONTIST TO THE DENTIST, THE PARENT AND THE PATIENT

By Bruce A. Curran, D.D.S., Cleveland, Ohio

THE following observations are of two sources: thirteen years of private practice and an extensive preliminary postgraduate training.

RESPONSIBILITIES TO THE DENTIST

The time and effort required by the dentist to determine whether orthodontic care is necessary, not to mention the effort of interesting and convincing the parent of the necessity, are too frequently overlooked by the orthodontist. Thoughtful parents have confidence in the judgment of their dentist. The decision to consult an orthodontist regarding the child's malocclusion may, in some cases, involve only a suggestion from the dentist, but in most cases it involves considerable time and thought.

It is then the first obligation of the orthodontist to acknowledge the reference of the patient either by the written or by the spoken word. This should be done before the orthodontist has made a complete diagnosis and a plan of treatment for the case, because there may be factors in the case history which it is to the best interest of the patient for the orthodontist to know. It is essential at this point also to determine what dental roentgenograms are required for the case. Full-mouth dental roentgenograms should be a prerequisite for complete diagnosis. These records will aid the dentist and the orthodontist in determining the requirements in immediate and future restorative procedures.

A definite understanding regarding examination and prophylaxis is essential. Certain conditions to the contrary may prevail in some cases, but it seems logical that the orthodontist assume the responsibility of instructing the patient regarding his mouth hygiene habits, to the end that no caries shall be attributed to the use of appliances. One means of accomplishing this is instruction of the patient regarding mouth hygiene and making certain that the instructions are followed; using prophylactic procedures in adjusting appliances; periodically examining the teeth and soft tissues, and referring the patient to the dentist at least every six months, with notations of your findings, for prophylaxis and examination.

The effect of the last procedure is threefold: 1. It is a double check on the presence or progress of caries. 2. It continues unbroken the biannual visits of the patient to the dentist, a schedule which he has given considerable energy to develop, for the purpose of maintaining dental health. 3. It affords the dentist an opportunity to observe progress of the patient's treatment at the orthodontist's hands and invites his suggestions. Occasionally, a case needs a restorative procedure at the conclusion of the treatment, and thus an opportunity is given him to study the case.

It is good practice at the conclusion of

Read before the Section on Orthodontia at the Eighty-Second Annual Meeting of the American Dental Association, Cleveland, Ohio, September 11, 1940.

active treatment to notify the dentist that we have informed the patient or parent of the need for his services regularly. Needless to say, it is our obligation to see that the patient returns to his dentist. Rarely are the circumstances such that a patient will change dentists during our treatment, but if our efforts to return the patient to the dentist are unsuccessful, it is well that we inform the dentist of the decision of our patient. This is a courtesy that should be observed, and it removes the slightest possibility of suspicion that might arise through silence.

The best expression of appreciation that we can offer to a dentist for reference of his patient to us is treatment of the case in such a conscientious manner that the best possible result is obtained. That is all that the progressive dentist expects.

RESPONSIBILITIES TO THE PARENT

It is well to remember that the parent, in most cases, is consulting us regarding the child's condition with considerable apprehension. This seems to me quite natural since orthodontic procedures are recognized generally as being rather involved as regards time and, quite often, expense, for which the family budget has to provide. It is also natural for the parent to desire as much information as possible after we have had an opportunity to examine the child's teeth. Much of the apprehension will be relieved and many questions can be avoided if we candidly state, as soon as possible, whether the case should be observed for a definite time, during which we will make recommendations, or should be treated immediately. Without waiting for questions, it is well to explain carefully and briefly why we have made our decision and what our routine procedure is for the case at hand. Most people rebel at a lack of understandable information regarding any important procedure concerning themselves, and our recommendation at this point is no exception. To be sure, this involves patience, thought and time.

The recommendation that there be a period of observation, which is often the proper one, should not be taken lightly. Complete records (models and roentgenograms) and a case history are essential for intelligent deductions over a period of time, at the conclusion of which the case can either be dismissed as normal, or active treatment be instituted.

The recommendation that active treatment be started entails definite responsibilities. Complete records as mentioned above are a prerequisite, and a consultation with both of the parents, if possible, is strongly recommended because one of the parents cannot convey all of the essential facts to the other, if it is necessary; a consultation at which we candidly and clearly explain (1) what degree of malocclusion exists and the etiology; (2) what our treatment procedure will be; (3) what our limitations are, if any; (4) what cooperation between ourselves and (a) the dentist, (b) the parent and (c) the patient consists of; (5) what the minimum and maximum time requirement for treatment will be, and (6) what the minimum and maximum expense will be. Obviously, this involves the time not only of ourselves but of the parents as well. Thoroughness and frankness here eliminate misunderstanding and unpleasantness later.

During treatment, it is definitely our responsibility to inform the parent if the patient is not cooperating, should such lack of cooperation imperil the result. While insistence on cooperation requires firmness and tact, it safeguards respect, not only for ourselves and every one involved, but for our profession as well. Every one enjoys a perfect result of their effort, but it takes courage to admit failure, however small it may be, when we honestly feel that Nature did not act just as we expected. This is a responsibility

that we will accept; namely, to discontinue treatment or recommend the opinion of a consultant.

It is almost needless to add that if the circumstances are such that, in the treatment of a case, time is required beyond the original estimate, and there has been cooperation, there should be no additional fees.

RESPONSIBILITIES TO THE PATIENT

It is not uncommon to observe apprehension on the part of the patient before the orthodontic procedure begins. This may be due to an unpleasant medical or dental experience in the past or to the exaggerated story of a companion. The approach to this type of case must be made with considerable thought and care. The confidence of the child must be won. A single word in its fullest meaning and expression can assure results; namely, kindliness. It is the fearful or apprehensive child that must be won over, in order that the experience which occasioned the fear shall not be followed by another unpleasant one. An affected manner of kindliness will not endure. There must be sincerity and patience.

When the parent insists on discussing expense at the first appointment, the patient must be the first and foremost consideration. By this, I mean that any discussion of fees may mean depriving the patient of treatment, because, without full knowledge of the facts in the case, we may quote fees that would be higher than we would quote otherwise, and higher than the parent could afford. A decision can then arise in the mind of the parent to dismiss any further consideration of orthodontia; and the patient suffers as the result. It is important for the welfare of the patient that all possible information be obtained before a diagnosis is made.

In considering treatment, too much emphasis cannot be placed on the important question, "Am I starting treatment at the proper time, when appliances will function for the shortest period of time to obtain the desired results?" Every conscientious orthodontist knows that appliances are a means to an end and that they should be operating no longer than is absolutely necessary. Prolonged active treatment periods are a thing of the past, thanks to those pioneers who developed efficient appliances, and to the modern investigators who with tireless effort have added to our knowledge of growth and development. These men have made possible a shorter period of treatment. It is well to remember here, however, that brevity in time does not mean speed at the expense of healthy tissue. Tissue tolerance must be recognized.

Treatment should be introduced with such a small degree of force that relatively no distress results. It is well to prepare the patient, by a precautionary word, for reactions which are expected to take place. The inquisitive patient should be answered completely and truthfully.

When the appliances have been placed, a lesson in the proper care of the teeth and appliances is a prerequisite for oral hygiene. The patient who has been unaccustomed to the presence of appliances in the mouth should be instructed with a toothbrush and a hand mirror so that he will know what the requirements are regarding this important phase of treatment. It is well at this point to explain briefly what is expected of him relative to cooperation, which may include the avoidance of sticky candies and the proper procedure in the event a part of the appliance becomes loose or is broken. The patient who deliberately breaks an appliance is an exception, but occasionally an appliance will break. Such an accident to an appliance I have usually regarded as a reflection on my own ability. I believe that the responsibility is the dentist's, because, with materials of highest quality, careful and correct application and the patient's cooperation,

appliances do not break. It should be remembered that such accidents are an inconvenience to the patient as well as ourselves.

It should be remembered that our cases are not material for experimentation. The place for testing new materials and appliances is in the laboratory or, better, an institution of learning. The strained economic conditions of the past few years have taught most of us to be resourceful, but not at the expense of quality.

The period of retention following treatment has been lightly regarded by some, with the result that relapses have occurred. Careful and thoughtful observation here is of prime importance. Usually, the third molars are not fully developed and this must be recognized if our service is to be complete. The patient should not be expected to recognize success or failure, and should not be dismissed until the orthodontist himself is convinced that he has done everything possible not only to obtain the desired result, but also to continue retention long enough that normal occlusion will become permanent.

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AN IMPROVED TECHNIC FOR PACKING AND CONDENSING UNIFORM AMALGAM RESTORATIONS BY HAND

By JAMES T. SWEENEY, D.D.S., Stockton, Calif.

IT has been said that more amalgam restorations fail from poor workmanship than from the use of poor alloys. Tingley[1] states that a dentist should appreciate the fact that a careful technic is far more important than the alloy used. Easton[2] has shown that factors in the majority of failures are entirely under the control of the dentist, the most common of which are faulty cavity design and preparation, improper application of the matrix and mismanagement of the amalgam during mixing and condensing.

NEED FOR BETTER AMALGAM WORK

My position at the Stockton State Hospital during the past fourteen years has enabled me to examine and study a large number of amalgam fillings made by other dentists, as well as those made by myself. The patients admitted to the hospital have far more fillings of amalgam than of all other materials combined. The number of failures in the mouths of the incoming patients during the early days of my work here was amazing. Occasionally, amalgam fillings were found that had given excellent service; but even these were tarnished, corroded, with defective margins, or otherwise unsightly.

These poor fillings were a challenge to me. I have never considered myself more skilled than the average operator, but I did decide to try to make better restorations than those generally seen. Over a period of time, my carefully made fillings were found to be little better than the ones seen in the weekly examinations of the new patients. There-

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Read before the Section on Operative Dentistry at the Seventy-First Annual Meeting of the California State Dental Association, San Francisco, April 21-22-23, 1941.

fore, an attempt was made to determine the cause of these failures. Were they the result of improper manipulation of the amalgam, or other carelessness of the dentist, or were they due, in part, to the intrinsic defects of the material?

Amalgams have many inherent defects. They expand, shrink and otherwise become distorted in use. It seems probable that if they, like the gold inlay, maintained their size and shape permanently, they would in truth be superior as tooth savers and the equal of gold foil fillings. It might be well, therefore, to examine the most common types of instability in amalgam fillings.

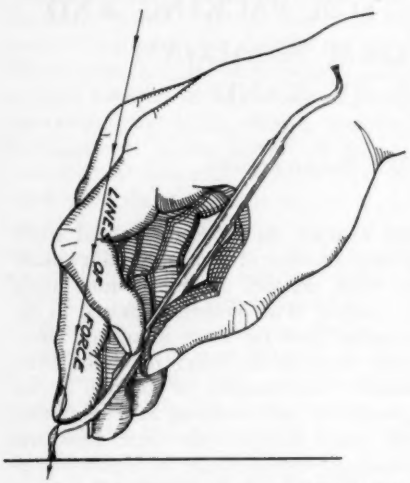

Fig. 1.—Condenser in hand, with middle finger in position on finger rest. This grasp permits the use of the muscles of the fingers, wrist and entire arm and shoulder to be exerted during condensation.

INSTABILITY IN AMALGAM FILLINGS

All certified alloys are so made as to assure amalgam fillings that will expand from 3 to 13 microns per centimeter (3 to 13 parts per 10,000) during the first twenty-four hours when treated as the manufacturer directs. Ward,[3] Hollenback,[4] Gray[5] and others have shown that the actual dimensional changes during the first twenty-four hours depend as much on the method used in amalgamating and handling as on the alloy used. Thus, great expansion, slight expansion or actual shrinkage may be obtained by different operators with the same alloy.

It is also known[5] that these volume changes may continue for an indefinite time. The effect of amalgamating and of packing the amalgam upon the long-continued volume changes has not been studied so much as its importance warrants; but it may be that this, delayed expansion or contraction, is among the important causes of amalgam failure.

Most of the amalgam fillings observed in our clinic have appeared to expand, bulging from the cavity. The amount of this distortion is not the same for all fillings, but varies from one patient to another and from filling to filling. The expansion may be only a few microns in a year, or it may amount to several hundredths, or even tenths, of a millimeter. The causes of this expansion are not definitely known. It may be the result of further action of the mercury and the other constituents; internal or external corrosion of the mass, or a too great thermal expansion of the amalgam in proportion to that of tooth substance, followed by failure to return to its original position. Whatever the cause, it is known that this expansion or bulging can injure or even ruin the restoration.

FLOW, FRACTURE AND ABRASION

Even though laboratory studies prove that amalgams flow when subjected to continuous or intermittent pressure, flow from biting stresses is not, I believe, of great clinical importance.[6]

Abrasion is frequently observed in the mouths of tobacco chewers and persons who grind their teeth while asleep. It was surprising to other dentists who have assisted me in gathering data on this work, as well as to me, to discover that the amalgam does not wear away so fast as the teeth. In nearly all cases, the

teeth seemed to wear away below the surfaces of the fillings. At least, in most instances, the fillings were left too high with no clinical evidence of plastic flow. Nearly always, these fillings eventually fractured. A low-flow amalgam fractured as readily as one of high flow.

EFFECTS OF TECHNIC

In view of these various types of instability in amalgam fillings, a question presents itself: Is it possible to eliminate or at least minimize, the subsequent distortion by methods of amalgamating the alloy and of handling the amalgam?

Two methods of handling amalgam before and during condensation are possible. The present popular technic is one in which excess mercury is purposely retained in the first few portions of amalgam introduced into the cavity. The main reason for leaving an overabundance of mercury in these first few portions is to insure the plasticity thought necessary for closer adaptation to the cavity walls. The last portions of amalgam are squeezed progressively drier with the hope of blotting up or absorbing some of the excess mercury purposely left in the cavity depths.

The second method is to express most of the excess mercury from each portion before it is carried to the cavity for condensation. Clinical experiments in our clinic here proved that it is unnecessary to leave much excess mercury in the mass in order to attain sufficient plasticity for adaptation. We have concluded that since retention of excess mercury in the finished filling tends to make it more unstable in shape and in size, an excess of mercury should never be introduced into the cavity at any time. I attempted, therefore, to develop a technic that would accomplish two desirable purposes: (1) packing and condensing of very dry amalgam, with satisfactory adaptation, and (2) packing and con-

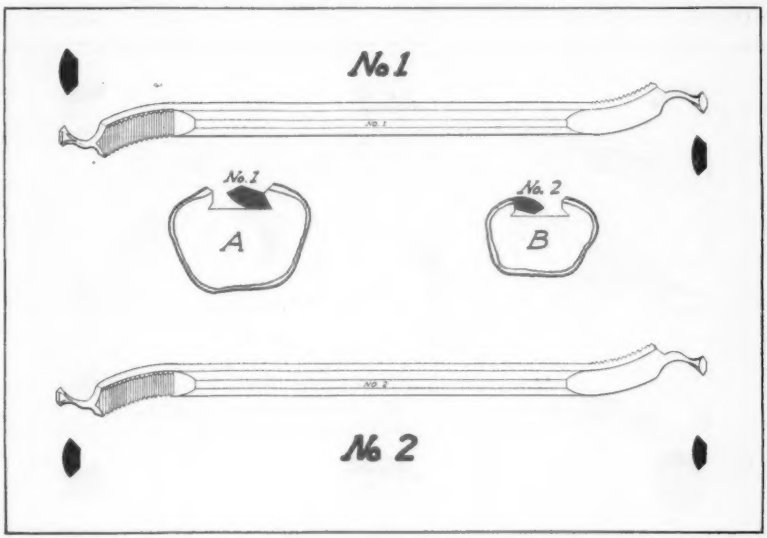

Fig. 2.—Above, condenser No. 1. A, cross-section through molar cavity, showing relation of condenser to undercuts. Below, condenser No. 2. B, cross-section of bicuspid cavity, showing relation of condenser to cavity margin.

densing in such a way as to minimize or eliminate instability in the finished restoration.

DEVELOPMENT OF THE IMPROVED HAND TECHNIC

The past ten years have been devoted to condensing amalgam from which relatively large amounts of mercury have been expressed. It was thought that mechanical condensation was necessary to plasticize the dry and sometimes crumbly amalgam within the cavity in order to obtain good adaptation. Various types of mechanical condensers and vibrators were tried,[7] but, in our experience, only the pneumatic condenser designed by George M. Hollenback was successful. The repeated mallet blows under steady hand pressure resoftened the extremely dry amalgam, facilitating adaptation. The many hundreds of fillings condensed with this instrument are outstanding in beauty and stability. As the first cost of the machine has prevented many dentists from adopting it in their practices, a series of studies were undertaken to find ways and means of resoftening the dry amalgam so that it could be packed by hand.

During 1939-1940, a great number of clinical fillings were made by kneading every portion of amalgam after it had been wrung through a "squeeze cloth," just before packing it into the cavity. After two years, the fillings, as far as can be determined clinically, are the equal of those made with the pneumatic condenser.

As the improved technic developed, it was found best to amalgamate the alloy carefully, following the directions furnished by the manufacturers. After amalgamation, the amalgam was rolled into a rope and divided into five or more portions except in the case of a very small mix.

The first portion was then squeezed through a cloth with finger pressure. It was then rubbed in the same cloth for five times until the feeling of crepitation was replaced by a smooth plasticity, at

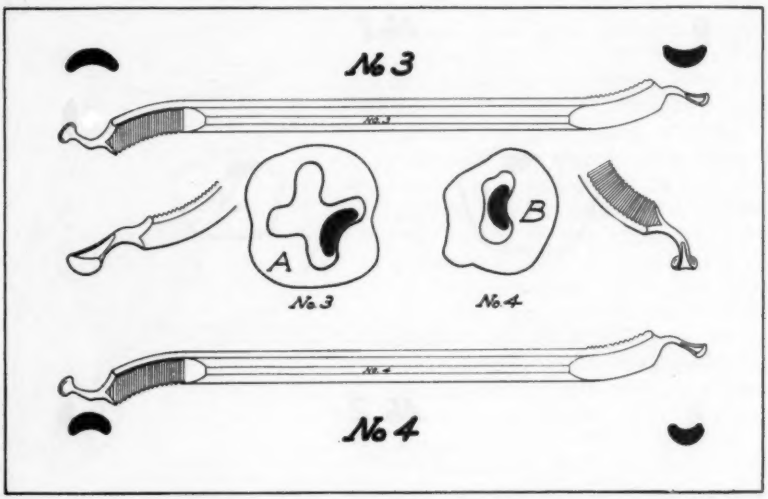

Fig. 3.—Above, condenser No. 3. A, condenser in relation to contours of occlusal cavity in molar tooth. Below, condenser No. 4. B, condenser in relation to contours of occlusal cavity in bicuspid tooth.

which stage condensation was begun immediately.

The squeezing of the amalgam through a cloth and its subsequent kneading in the same cloth for five times to restore plasticity are a very important part of the technic. Also the correct finger pressure during squeezing is essential to remove the right amount of mercury. Removing too little mercury leaves the mix too wet for best results, while removing too much is even worse. Removing too much mercury leaves the piece of amalgam with so little excess that rubbing from eight to ten times may be necessary to restore the plasticity required for adaptation to the cavity walls. This causes the amalgam to set too rapidly for convenience in condensation.

The greatest finger pressure of most dental assistants does not remove too much mercury, but the pressure effected by the dentist usually does. Our standard plan to determine the correct squeeze pressures is to have each operator make a few trial mixes, wringing the first portion of the mix with the maximum strength. If this piece does not become plastic with five rubbings, the next portion is wrung with slightly less pressure; and so on, until the exact pressure for that person is found at which five rubbings will result in a smooth, plastic mass without crepitation.

For those who make use of the pneumatic condenser for amalgam, hand rubbing five times is unnecessary and undesirable. With this instrument, the dry, unresoftened mass should be condensed directly in the cavity. The tamping action of the machine replasticizes the material within the cavity. Resoftening the mix before packing is necessary only when packing by hand.

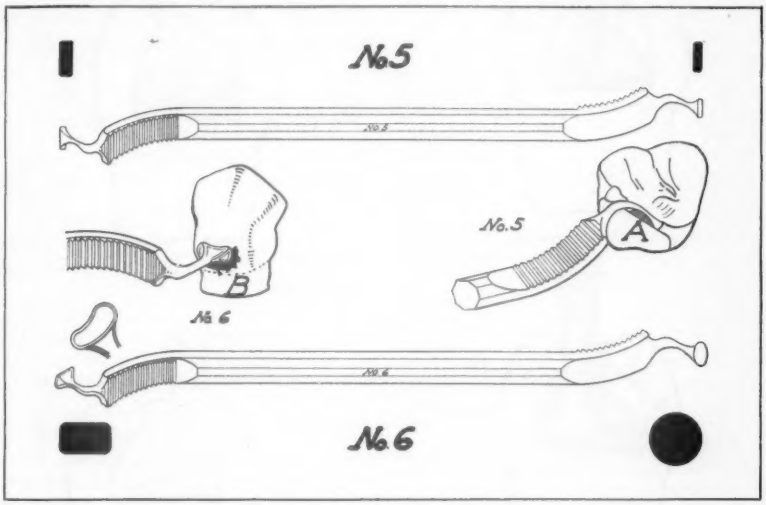

Fig. 4.—Above, condenser No. 5. A, condenser in relation to groove extension in upper first molar. Below, condenser No. 6. B, condenser stepping over-filled gingival filling.

For use in hand condensation, instrument manufacturers have adapted handles to the condenser points of my design. One set, illustrated in Figures 1, 2, 3 and 4, is suited to packing amalgam into the posterior teeth. The handles are made with finger rests, which permit packing pressures never before realized in our experience. (Fig. 1.)

Hand condensers Nos. 1 and 2 (Fig.

2), are for use in the proximal extensions of the Class II and mesioclusodistal cavities; Nos. 3 and 4 (Fig. 3), for Class I cavities and occlusal extensions in the molars and bicuspids. Hand condenser No. 5 (Fig. 4) is ideal for packing into the lingual grooves of upper first molars and into all similar groove extensions, whereas the concave rectangle No. 6 is found useful in stepping the overfilled Class V filling. Two other handles, not

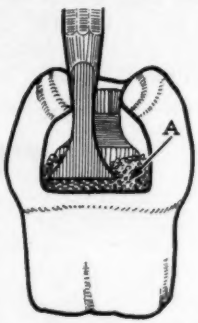

Fig. 5.—A, escape gate.

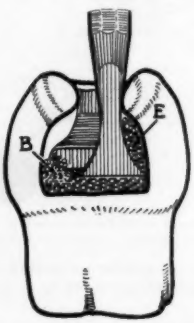

Fig. 6.—B, new escape gate. E, excess plashy amalgam trapped on ledge of condenser.

illustrated, are available for use in exceptional locations.

THE IMPROVED HAND TECHNIC

Trituration is accomplished according to the directions furnished with the particular alloy. The resultant amalgam is rolled into a rope and divided into convenient portions, usually five. The first portion is squeezed through a cloth with a predetermined amount of finger pressure, as previously described. It is resoftened by rubbing five times in the same squeeze cloth and is now ready for packing and condensation.

The first resoftened portion is held between the thumb and the finger. A small piece is taken from the portion and

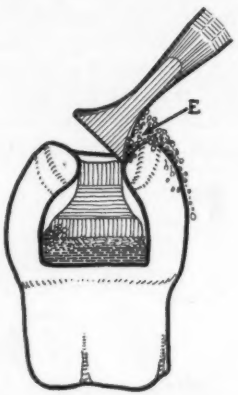

Fig. 7.—E, excess plashy amalgam expelled from filling.

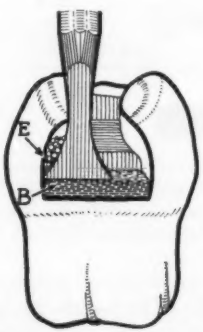

Fig. 8.—B, new escape gate. E, excess plashy amalgam. In closing the new escape gate, the excess plashy amalgam is trapped on the ledge of the condenser.

pressed into the cavity with a condenser that occupies one-half or more of the surface to be packed.

Heavy condensation thrusts may now be applied. By keeping the condenser in

contact with one cavity wall, an escape gate is formed between the tool and the opposite wall. (Fig. 5 A.) With a rocking motion, maintaining continued pressure, the instrument is worked across the surface to close the escape gate at A, automatically trapping the excess, mercury-saturated amalgam (Fig. 6E) on the ledge of the instrument and creating a new escape gate at B. This excess (E) is removed at once by removing the instrument from the cavity (Fig. 7E). The condenser is replaced in its last position (Fig. 6), and the mass compressed, the operator working toward the opposite wall, closing the new escape gate (B) and trapping the unwanted excess amalgam (Fig. 8E), which is then removed

TABLE 1.—REPORT ON FLOW AND VOLUME CHANGE AS GIVEN BY MANUFACTURERS OF TWENTY-TWO ALLOYS USING IMPROVED TECHNIC AS COMPARED TO USUAL METHODS*

Flow		Volume Change	
Reduced	Equal	Reduced	Equal
17, or 77.2%	5, or 22.8%	19, or 86.4%	3, or 13.6%

*At no time was the expansion reduced below the minimum required by the Research Commission of the American Dental Association.

from the filling. With another small piece of amalgam, the operation is repeated until the resoftened amalgam held in the hand is used up.

In packing amalgam, very small pieces should be added in order that the packing force shall be completely effective, and sufficient time should be taken to pack thoroughly and to eliminate properly the excess, weak, mercury-diluted amalgam from each piece before proceeding with the next.

My experience with dentists who come to my laboratory for information on the technic is that they attempt to force into the cavity portions of amalgam that are much too large; in which case, most of the packing force is absorbed by the resistance of the particles to flow before the force is effective in condensing the material at the walls and the floor of the cavity.

The second portion of amalgam is taken from the bracket table, squeezed through a cloth and rubbed to a working plasticity in the same cloth. It is then condensed in the same manner as the first portion (packing small pieces at a time). In all cases, the excess soft amalgam is eliminated on the ledge of the condensing instrument from each

TABLE 2.—MERCURY CONTENT OF SAME ALLOY MADE BY THREE DIFFERENT MANUFACTURERS*

Test	Mercury Content Per Cent
90	40.1
91	40.2
107 top	40.54
107 bottom	41.40
108 top	40.71
108 bottom	41.40
121 top	42.5
121 middle	42.4
121 bottom	42.75
122 top	43.2
122 middle	42.3
122 bottom	42.5
138 top	42.35
138 bottom	41.29
139 top	43.18
139 bottom	42.71

*Specimens 138 and 139 were made from the same alloy, but a different batch. All tests were made from the same alloy. (Average of sixteen tests: 41.85% mercury.)

piece under condensation before proceeding with the next one. Packing and condensing are continued in this way to completion of the filling. The use of extra dry plier-squeezed amalgam is not necessary at the finish, since the recoverable excess mercury has been removed during the packing of each piece.

A few years ago, Ward and Scott[8] showed that amalgam that has lain on the bracket table for five minutes or more before condensation retains more mercury in the finished filling than that

which is condensed soon after amalgamation is completed. In order to avoid the retention of this excess mercury, I have adopted the "installment plan" of amalgamation and condensation for all restorations extensive enough to require more than three to five minutes. Many alloys of today can be amalgamated in forty-five seconds or less in a mortar and require only five to ten seconds in the mechanically operated amalgamating devices. By standardizing a mix of 1 gm. (15.4 grains) of alloy and the specified amount of mercury for each mix, a second or third mix can be made for these large fillings, assuring the operator a continued supply of fresh amalgam.

RESULTS OF THE IMPROVED TECHNIC

The withdrawal of considerable excess mercury from each piece of amalgam before packing, together with the further removal of much of the mercury-rich material during condensation, results in fillings with an unusually low mercury content, as demonstrated in laboratory tests. (Table 2.) The fillings in use are distorted less, tarnish less, have a smoother finish and do not present the jagged margins common to most fillings made with "wetter" amalgam. While there is a tendency toward delayed expansion, expansion is much less than when plashy amalgam is used.

One of the most economic features of the technic is that it saves time. While the squeezing and kneading of each portion of amalgam before packing take about thirty to sixty seconds for extensive restorations, five to ten or more minutes is saved because of the advancement of the setting time. Carving of the occlusal surface should proceed at once; otherwise, the filling becomes so hard that carving with instruments becomes difficult. The matrix may be removed immediately. I cannot remember an instance in our clinic when the marginal ridge has fractured from forceful withdrawal of the matrix band at once.

LABORATORY RESULTS

My own laboratory results showed that this technic improved the physical properties of the amalgam made from all of the various alloys that I had put to use in the clinic. But would the technic improve the physical properties when other operators tried it? In order to answer this question, I called upon eleven manufacturers of twenty-five alloys which were certified to the Research Commission of the American Dental Association. Ten of them responded.

Representatives of the manufacturers agreed to make tests for flow and for volume change of amalgams made from their own alloys, using my technic, and to compare the results with those that they obtained when their usual technics were applied. The results are shown in Table 1. The reduction of expansion on nineteen alloys representing 86.4 per cent of the twenty-two ultimately tested was in no case sufficient to make the total less than the 3 microns per centimeter minimum that is required by the American Dental Association Specifications.

The reduction of flow on seventeen alloys, or 77.2 per cent of the twenty-two tested, is significant. The flow on five of the alloys was not reduced, according to the manufacturers' reports, but at no time was it increased.

The representatives of three of the manufacturers also ran analyses of the mercury content of specimens that I packed. The mercury content of these specimens is listed in Table 2. Tests 90 and 91 were made from 4 by 8 mm. flow specimens packed with a round-faced condenser 3.5 mm. in diameter. One mix of 1 gm. (15.4 grains) of alloy to 2 gm. of mercury was used in each 4 by 8 mm. mold. Seven minutes was consumed in trituration and condensation. All other mercury tests were made from 6 by 12 mm. specimens, using the same alloy and the same alloy : mercury ratio. The "installment plan" of amalgamation and packing was used for these large fill-

ings. Five mixes were made during the progress of the filling operation, and at no time was more than four minutes required to condense any one mix. The unusually low mercury retention of these specimens is interesting as they averaged but 41.85 per cent mercury content for sixteen tests.

The results of this clinical and laboratory research, carried on by different men in different localities, the many collaborators working without the knowledge of what the others were doing, indicate that this improved hand technic has value, and that it can be mastered with little practice by any one who can follow written directions. Both the clinical and the laboratory evidence are encouraging. They show that the technic does help to minimize the dimensional changes of the amalgam. It is known that these changes are among the major defects of amalgams. Further clinical observations of the fillings made by this improved technic are planned at the Stockton State Hospital. If they are as favorable as these preliminary deductions lead us to believe they will be, we shall have advanced a step nearer to the solution of the problem of the dimensional instabilities of amalgam as a filling material.

SUMMARY

1. Among the leading causes of amalgam failures are the dimensional instabilities of the finished restorations.

2. Adaptable plasticity can be attained without the aid of an overabundance of mercury.

3. An improved hand technic makes fillings of lower mercury content than is obtained by other hand technics.

4. The new technic has been proved superior to other hand technics in clinical tests.

5. The laboratory tests of the physical properties of twenty-two alloys made by ten manufacturers show that a majority are improved, a few equaled and none harmed by the improved hand technic.

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EXTRA-ORAL ROENTGENOGRAPHIC TECHNICS, USING THE CASETTE TABLE

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EXTRA-ORAL roentgenography is an important part of both medical and dental roentgenography. It has often been neglected by both professions, because of lack of a simple, convenient and workable technic. The casette table, shown in Figure 1, has been developed for the purpose of perfecting such a technic. The casette table technic has been developed for the use of the roentgenologist and general practitioner, to obtain conveniently and satisfactorily diagnostic extra-oral roentgenograms, and not for scientific research. It also affords much positional comfort to the patient. The technic is not new, but is a great improvement over those used at present, for both the operator and the patient.

The casette table, a "glorified" angle board, is simple of construction, easy to manipulate, efficient in operation and a nice-appearing piece of equipment. The general dimensions are as follows: height, 36 inches; width, 25½ inches; over-all thickness, 10 inches for table top; for base, 14 inches. This table can be used with either a dental chair or an ordinary straight chair. A dental chair is preferable because the elevation of the patient when seated can be varied. This change in elevation, the only adjustment necessary, with the chair, is to compensate for the difference in height of the various patients. The table is so designed as to be freely moved to any position in front or on either side of the chair; which gives free access to every position necessary for extra-oral roentgenography.

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TECHNIC

The steps in the extra-oral technic are as follows: 1. The table is moved into position. 2. The casette is placed (with markers). 3. The height of the chair is adjusted. 4. The table top is positioned to the patient's head. 5. The table reading is made. 6. The angulation is adjusted. 7. Exposure is made.

MAXILLARY SINUS TECHNIC

The patient is seated in an upright position in the chair and the table is moved into position in front of the patient. (Fig. 3.) The edge of the table top will be approximately parallel with a line drawn through the front tips of both arm rests of the chair. The casette is placed on the adjustable table top (marked L and R for left and right, respectively). The chair height is adjusted to a position in which the patient's chin is about 4 or 5 inches above the table top. The patient's arms are placed over the ends of the stationary table top, for comfort and stability, and the head is tipped forward in a comfortable position. The table top is raised to fit the nose and chin of the patient snugly. (The mouth can be either closed or open.) The adjustable table top will automatically lock in any position desired. The necessary adjustments are made for the patient's comfort. The table reading is taken and, by consulting Chart 1, the tube angulation is set. For example, if the table reading

is 65°, the vertical tube angulation will be 45°. The long axis of the tube, or horizontal angulation, will be parallel with the edge of the table top. The central ray is directed parallel with the sagittal plane to pass directly between the maxillary sinuses. A film target distance of from 24 to 30 inches should be used. The exposure time for adults, using ultra-speed screens, will be from five to eight seconds, depending on the size of the head and the age of the patient.

These tables (1-4) are computed for

Fig. 1.—Extra-oral casette table.

the ordinary or normal cases. The angulation may have to be changed slightly for varied cases. Also, the angulation may have to be varied when the operator wishes a specific area recorded and is not especially interested in the rest of the entire field.

FRONTAL SINUS (NOSE, TURBINATES AND ETHNOIDS) RECORD

The frontal sinus technic is the same as that for the maxillary sinus except for step 4. The patient's head is bowed slightly more and the table top and casette are adjusted to fit the patient's nose and forehead. The same angulation chart, film target distance and exposure time are used.

LATERAL JAW (RAMUS AND MOLAR REGION) RECORD

The patient is seated in an upright position in the chair and the casette table moved to a diagonal position at the side of the patient. (Fig. 2.) The chair is adjusted so that the top of the table is approximately 6 inches below the top of the patient's shoulder. The patient's

Fig. 2.—Casette table in position at side of chair, adjusted to patient for lateral temporomandibular record.

arm (the one next to the table) is placed on the table as shown in Figure 2. The head is tipped sideways toward the table and the table top and casette are adjusted to the side of the head. The ear should be snugly against the casette and the nose about 2½ inches from the casette. This should put the patient in a comfortable position. If not, the angle of the table top is changed to a comfortable position, care being observed to keep the head in the correct relation to the casette after the change is made. The table reading is taken and, from Table

2, the correct vertical tube angulation is made. With a 4 to 6 inch skin target distance, the central ray is directed to pass about one-half inch below the angle of the jaw and through the area that is to be of the most vital interest in the roentgenogram. This will make the long axis of the tube approximately parallel to the plane of the casette. The exposure time with double intensifying screens will be one to one and one-half seconds without screens, but with super speed films, from six to seven seconds. The same technic and table applies to both right and left sides.

Fig. 3.—Casette table in position in front of chair, adjusted to patient for anteroposterior temporomandibular record.

LATERAL JAW (BICUSPID AND MOLAR REGION) RECORD

The technic for the bicuspid and molar region is very much the same as for the molar and ramus region except for the position of the head in relation to the casette. The head is tilted in the same manner. The table top and casette are adjusted to the head so that the cheek is flat against the casette and the nose touching or almost touching the casette. The same film target distance, angulation chart and exposure time are used.

LATERAL TEMPOROMANDIBULAR RECORD

The table is set against the side of the chair on the side of the patient on which the articulation is to be recorded. The chair is adjusted so that the top of the patient's shoulder is from 4 to 5 inches above the top of the table. The patient leans toward the table and places the arm next to the table upon the stationary top, as shown in Figure 2. The head is tipped slightly toward the table and the casette adjusted to fit against the side of the patient's head. The ear and the temple should be snug against the casette. The table reading is taken and, from Table 3, the tube angulation

Fig. 4.—Casette table in position in front of chair, positioned to patient for bregmamentum record.

is set. The central ray should be directed through a point 2 inches above and one-half inch anteriorly from the external auditory meatus. The long axis of the tube should be parallel with the sagittal plane. With the tube in this position and the designated angulation toward the inferior aspect, the central ray will emanate at the temporomandibular articulation next to the film. The film target distance should be 20 inches and the time of exposure with double intensifying screens, for adults, from three and one-half to four and one-half seconds.

ANTEROPOSTERIOR TEMPOROMANDIBULAR RECORD

The patient is seated in the upright position in the chair. The table is positioned in front of the patient as for the maxillary sinus technic. The chair is adjusted so that the top of the patient's shoulders is about 6 inches above the top of the table. The patient's arms are placed over the stationary part of the table as in the maxillary sinus position. The head is tipped forward and the table top and casette are adjusted to the head so that the nose touches the casette at about the center. The chin and forehead should be equally distance from the casette. This positioning can best be carried out by placing small cork blocks under the chin and forehead for support. (Fig. 3.) This support will afford a comfortable position for the patient. The table reading is taken and the angulation of the tube set from Table 4. The central ray is directed through the head midway between the ears and to pass just below the nose. The film target distance should be 24 inches and the exposure time with double intensifying screens for adults from six to seven seconds.

TABLE 1.—MAXILLARY SINUS; FOREHEAD AND NOSE; NOSE AND CHIN

Table Reading	Tube Angulation
20	90
25	85
30	80
35	75
40	70
45	65
50	60
55	55
60	50
65	45
70	40
75	35
80	30
85	25
90	20

TABLE 2.—LATERAL JAW

Table Reading	Tube Angulation
90	—8
85	—3
80	2
75	7
70	13
65	18
60	23
55	28
50	33

TABLE 3.—LATERAL TEMPOROMANDIBULAR RECORD

Table Reading	Tube Angulation
90	15
85	20
80	25
75	30
70	35
65	40
60	45
55	50
50	55
45	60

TABLE 4.—ANTEROPOSTERIOR TEMPOROMANDIBULAR RECORD

Table Reading	Tube Angulation
40	50
45	45
50	40
55	35
60	30
65	25
70	20
75	15
80	10
85	5
90	0

LATERAL HEAD RECORD

For the lateral head record, the chair and table positions are the same as those used for the lateral temporomandibular procedure. The table top and casette are adjusted to fit snugly against the ears,

with the sagittal plane parallel with the plane of the casette. The table reading is taken and the angulation determined from Table 4. The central ray is directed to pass through the head at a point one and one-half inches anteriorly from the external auditory meatus and perpendicular to the sagittal plane. The film target distance should be 24 inches. The exposure time with double intensifying screens is, for adults, from seven to eight seconds.

PROFILE RECORD

The table position, head position, table setting and angulation for the profile technic are the same as that used for the lateral head procedures, with the exception that a film target distance of 72 inches should be used. For convenience in setting the correct tube angulation, the table top and casette should be set at 90°, so that difficuties will not be encountered in using a 72-inch film target distance. The exposure time with double intensifying screens is from one and one-half to two seconds.

BREGMA-MENTUM RECORD

Films taken by this technic give excellent views of the heads of the condyles, the coronoid processes and the rami.

The bregma is that point formed by the fibrous articulation of the two parietal bones and the frontal bone. The mentum is the anterior-inferior border of the synthesis of the mandible.

The table is positioned in front of the patient in the same manner as in the maxillary sinus procedure. The chair is adjusted so that the top of the patient's shoulders is approximately 6 inches above the table top. The table top reading is set at 0 for this technic. With the patient's chin in the mento-anterior position, the chin should touch the casette at a point about two-thirds the distance to the opposite border and midway between the lateral borders. The near border of the casette should touch the clavicle region at approximately its superior border. (Fig. 4.) The central ray should be directed to pass through the bregma and mentum. This will give a tube angulation of approximately 10°. The film target distance should be 24 inches and the exposure time for adults, using double intensifying screens, will be from seven to nine seconds.

TABLE MODIFICATIONS

The adjustable table top can be modified to suit many purposes. A change tunnel can be incorporated for stereoscopic roentgenography. Also, a compression band can be added to help in stabilization during stereoscopic procedures, but it is not generally necessary for regular extra-oral work.

CONCLUSION

This technic adequately serves the purpose of general diagnostic extra-oral roentgenography. It affords comfort and ease for the patient in all necessary extra-oral positions. The technics for the operator are easy, simple and efficient. Most important of all, satisfactory diagnostic extra-oral roentgenograms are obtained.

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SALIVARY CALCULI

By W. I. Jones, D.D.S., Columbus, Ohio

THE art of distinguishing one disease from another and the ability to determine the nature and cause of pain are absolutely essential to the successful treatment of any departure from a state of health whether it be in the realm of dental surgery or in that of general medicine.

The following case illustrates the necessity for a careful evaluation of all the evidence presented.

Fig. 1.—Dense rounded mass at lower border of mandible, on right side. It was difficult to say whether the mass was inside or outside the mandible.

History.—A woman, aged 69, rather frail and asthenic, presented a multiple vitamin deficiency, mild hypertensive cardiac vascular disease, slight impairment of the hearing and some signs of senility. She had been hospitalized for rest and observation and she complained of many bodily aches and pains of moderate degree following a supposed influenza and the extraction of the teeth about ten weeks previously.

The particular pain that occasioned my entrance into the case affected the oral cavity and the region of the right lower jaw.

Mouth Examination.—The lips were red and the tongue was very red, with papillary atrophy, and somewhat sore. There was no swelling or pus. Pain was elicited upon pressure on the alveolar ridge and the floor of the mouth, with a rather free intermittent flow of saliva that was aggravated by eating or even by the odor of food. This symptom, which is often indicative of either a partial or complete obstruction of the salivary ducts, in this case arose in Wharton's duct.

Roentgenographic Examination. — Small

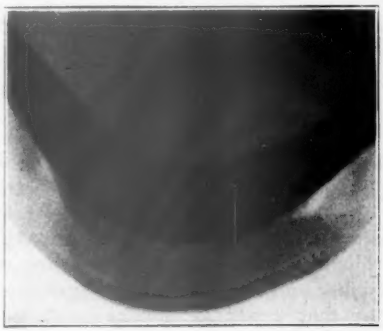

Fig. 2.—Definite location of mass inside mandible and about three-fourths inch linqually from bone. In this case, the calculus was in the submaxillary gland, near the opening to Wharton's duct.

dental films disclosed no root abscesses or tooth fragments. A lateral roentgenogram of the jaws (Fig. 1) showed a shadow of a dense mass near the lower border of the mandible about 1½ inches anteriorly from the angle, on the right side.

An occlusal plane roentgenogram (Fig. 2) definitely located the mass on the lingual surface of the mandible.

Operation.—The mass was removed intra-orally, under local anesthesia, through an incision 1½ inches long in the floor of the mouth. Then, with curved artery forceps

and by blunt dissection, the opening was enlarged in the direction of the mass sufficiently to admit the introduction of the left index finger under the calculus. Then with the finger as a traction hook and stabilizer, and with continued blunt dissection, to remove the surrounding tissue, the mass was gradually "teased" toward the opening in the floor of the mouth where, with a sharp knife, it was dissected from its bed in its entirety. It proved to be a salivary calculus, roughly roundish, spiculated and three-fourths inch in diameter. Pain was abolished, and the wound quickly healed.

CONCLUSION

1. A patient should not be accused of emotional instability until all the possible physical causes of distress are eliminated. There are probably not so many neurotics as there are poor diagnosticians.

2. X-ray pictures must be taken from more than one angle.

3. A sharp knife should not be used unless the operator can see what he is cutting.

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A NEW TECHNIC FOR TAKING IMPRESSIONS FOR STABLE LOWER DENTURES

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ANY discussion of the technic here presented must begin with an acknowledgment of my debt to Sidney C. Fournet, of New Orleans. His brilliant analysis of the principles of stability and his practical demonstration that they could be incorporated into lower dentures have furnished an indispensable foundation for the present technic. Further, he must be recognized as one who has ended dentistry's long quest for a method whereby any lower jaw may be fitted with a truly stable denture, a denture that will function as part of the jaw.

Although there is no mouth which an experienced and competent operator cannot fit by using Dr. Fournet's technic, certain features of the technic have nevertheless prevented stable lower dentures from coming into general use. First, the difficulty and complexity of the technic have discouraged many dentists entirely. Second, the amount of time which the execution of the technic consumes has compelled those who have mastered it to set a fee entirely beyond the capacity of the average purse. Still, the result obtaind by the Fournet-Tuller technic has made every man who has used it ashamed to give his patients anything less, and there are few such dentists who have not striven and hoped for some shorter and simpler way to the same result.

My first effort toward a shorter and simpler lower denture technic was finally successful, although not until much later. To take a final upper impression, I had long used a "trubase" tray prepared from a preliminary compound impression. To eliminate from this tray the distortions carried over from the preliminary impression, the tray is taken as it comes from the laboratory and fitted directly to the maxillae. This is done by first heating a section of the flange to soften

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it, and then, after inserting the tray in the mouth, ironing the heated portion firmly to place directly against the tissue. This process is continued until the entire flange has been heated and molded to place as in the present lower denture technic, with care to establish a perfect peripheral seal. As a result, the fitted tray is stable in itself, all voids between the flange and the jaw and all other defects affecting stability having been entirely eliminated.

When I endeavored to apply this technic to the lower jaw, I found that it would produce a denture of almost rocklike stability. At the time that I first tried it, however, I was completing

Fig. 1.—Aluminum tray bent and shaped for use in very flat mouth.

my impressions by taking a wash with "plastogum," in order to eliminate the inequalities of pressure within the tray, which, after molding, remain as an important defect. In the lower mouth, "plastogum" proved an utterly inadequate medium for equalizing pressure, the result being abrasion and soreness so general and severe that, for the time being, the technic was impracticable for taking lower impressions.

Nevertheless, as a method for quickly and easily obtaining perfect stability, the technic was a success. A search was therefore begun for some medium that could effectively equalize the pressure of the fitted tray against the tissues. After repeated disappointments, one of my friends brought me a sample of the impression wax recently perfected by Lynn C. Dirksen, of the State University of Iowa.* Under pressure, this wax flows at mouth temperature. It indicates clearly every spot where the pressure of the tray on the underlying tissues is too severe, and every spot where it fails to contact the tissue, and provides a means for correcting these defects.

ADVANTAGES

Three important advantages of this new lower technic are self-evident: It requires infinitely less time; and it is much easier to use and easier to learn. All three advantages are due solely to the fact that the materials with which the new technic is executed permit working toward definite objectives in a definite and precise way. For the dentist, these advantages mean an end to the former prohibitive cost of stable lower dentures in time and effort. For the public at large, they mean that stable lower dentures can now become available everywhere.

The technic has two other advantages: It is much easier on the patient, and it produces a denture which is more stable. The first of these advantages is due to the substitution of Dirksen's wax for compound as the medium for taking the final impression, thus eliminating the necessity for repeated insertions of trays of hot compound in the mouth. The second advantage is merely another result of the precision of the technic. It achieves its objectives fully, instead of approximately.

*DIRKSEN, L. C.: Composition and Properties of Wax for Lower Impressions. J.A.D.A., 26:270, February 1939.

OBJECTIVES OF THE TECHNIC

For a denture to be both stable and comfortable, the impression for it must meet two requirements: It must extend in all directions to the correct outline, and it must be in uniform firm contact with the underlying tissues throughout this extent. We have already seen that the contact must be equal and uniform in order to prevent soreness and damage to the tissues. The contact must also be uniformly firm in order to brace the denture against any sidewise or other movement in the plane of the jaw. It can be so braced only by fitting it closely and accurately against the skeletal structure of the jaw.

ture only, can and will hold it in place. Obviously, if the outline of the denture is to be correct for this purpose, its periphery must, as far as possible, be in continuous contact with soft tissue throughout its length. The gentle pressure of the soft tissue against the edge of the denture thus establishes a positive seal which will maintain itself under all circumstances. The correct outline must also make provision at the periphery for the accommodation of muscles that play across it. Otherwise, the flexing of the muscles would quickly break the seal. Thus, the correct outline is a somewhat irregular line which encloses all the surfaces needed for bracing,

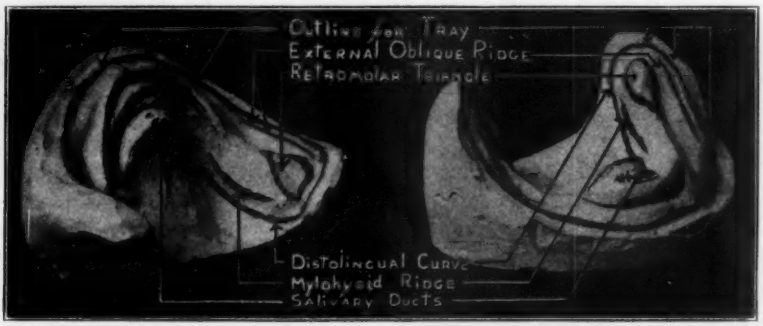

Fig. 2.—Plaster model showing outline for final impression tray. Arrows indicate the convex curve of this outline in the distolingual area. The external oblique ridge and mylohyoid ridge have also been blackened and indicated in order to show their normal position relative to the outline. The distance by which the outline for the heel of the tray passes back of the retromolar triangle to establish the extreme distal point of the denture is also indicated. The blackened area between the labial and anterior lingual outlines has been resorbed.

The impression must extend to the correct outline, partly so that all areas necessary as bracing surfaces may be covered, and partly to secure a perfect atmospheric seal. On this seal depends the stability of the denture in the face of stresses which would otherwise push it away from and out of the plane of the jaw. Once a seal against the outside air is established, the atmospheric pressure of 15 pounds to the square inch, pressing now on the outside of the denmakes allowance for muscles and muscle attachments and follows soft tissue all, or nearly all, the way. For each mouth, there is only one narrow path which such a line can follow.

It is apparent that when a denture is thus secured against any motion whatever relative to the jaw, either horizontal or vertical, it will function as part of the jaw. Any kind of food can be eaten with it! And its stability will give patients the same feeling of confidence and

security as if the teeth were their own.

TECHNIC

PREPARING A MODEL OF THE MANDIBLE

As we have seen, the "trubase" tray for the final impression is prepared from a preliminary impression. The effort to achieve the objectives of the technic begins with the preliminary impression, taken in high-fusing compound, and the requirements are as follows:

1. The preliminary impression, and the model prepared from it, must present a reasonably accurate reproduction of the skeletal structure of the jaw, since it is against this that the denture must fit if it is to be secured against horizontal movement. This is the reason that high-fusing compound is used; i.e., so that all soft tissue may be displaced and an impression of the skeletal structure be obtained. In particular, the impression of the crest of the mandibular ridge must be perfect, since this portion of the tray is heavily reinforced and cannot be remodeled in the mouth.

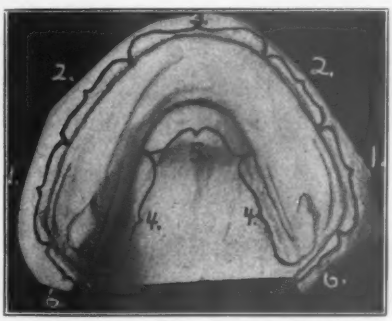

Fig. 3.—Plaster model showing outline for final impression tray. The brackets indicate the extent of the areas named as follows: 1, distobuccal. 2, molar and bicuspid. 3, labial. 4, distolingual. 5, anterior lingual. 6, heels. The order in which the areas are named is the order in which the various portions of the flange are molded to place. (Step 9.)

2. The impression of the mandible must extend in every direction to the flexion lines, real or apparent, where the tissues over the mandible join the tissues of the lip and cheeks on the one side and the tissues of the floor of the mouth on the other.

(The flexion line on the side of the lip and cheeks is a real flexion line; although, as it appears on the preliminary impression, and on the plaster model subsequently made from this impression, it is displaced slightly downward by the bulk of the impression. The apparent flexion line in the distolingual area is only imaginary, however. It is formed because the bulk of the preliminary impression squeezes the tongue into the center of the mouth and stretches tissues which ordinarily lie far below the mylohyoid ridge, up and out of their normal position. Real or imaginary, these flexion lines are important. They mark the outside limit for the correct outline of the denture.)

Preparation of Aluminum Tray.—The first step in the technic, an important step, is to prepare the aluminum tray in which the preliminary impression will be taken. In preparing this tray, the object is to fit it to the jaw accurately enough so that, when it is filled with compound, pressure applied to it will compel the compound to displace all soft tissue and will force compound to all the flexion lines.

No stock tray can be used without alteration, and, therefore, the two most desirable attributes of a tray are (a) that it be thin, so it can be bent readily into shape, and (b) that it be cheap. Trimming and bending two or three basic sizes for use in various mouths, I have built up a stock of trays of almost every conceivable size and shape, which I use over and over again, with slight alterations each time.

After examining the mouth thoroughly, both digitally and with lamp and mouth mirror, a tray which approximates the

size of the jaw closely is selected. It is then cut and bent until it follows the curve of the ridge. At any point where it will help in bending the tray to shape, we cut deeply into the flange with shears.

The lingual flange must extend at least one-fourth inch below the mylohyoid ridge and, in front of this, to the floor of the mouth. If the tray interferes with the lingual or labial frenum, it is trimmed until the frenum is unobstructed. By bending and turning up the heel, the tray is fitted well up on the ramus, so that compound will be carried at least 2 mm. beyond the distal point of the retromolar triangle. Around the outer border, it is extended to the flexion line.

Correcting the First Impression.—There is undue distortion in the impression just taken, owing to the great bulk of compound necessarily present, and, frequently, to insufficient care in shaping the aluminum tray. To reduce this distortion, a second impression is now taken in low-fusing compound, with the first impression as a tray.

The first impression is reduced as much as possible by trimming off all we can of the now hardened compound outside the flexion lines. Then the impression is chilled thoroughly and dried. With a hot spatula, an even thickness of melted red compound is spread over

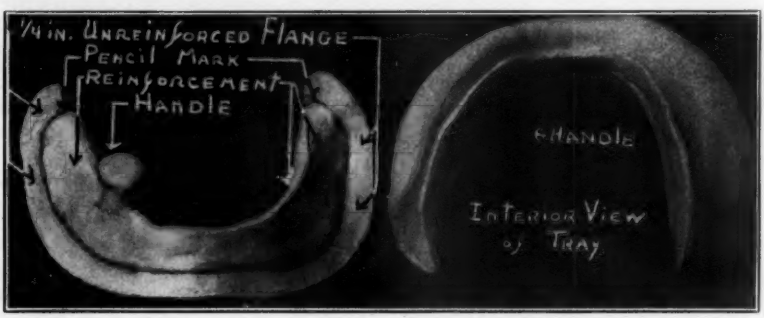

Fig. 4.—Tray.

Impression in High-Fusing Compound.—The aluminum tray is filled with softened high-fusing compound; just soft enough that it can be seated. If too soft, the superior displacing qualities of the high-fusing compound are lost. The tray with impression is seated evenly and firmly; then chilled in the mouth, and withdrawn.

Care is exercised to seat the impression evenly. Rocking it will spoil the impression of the crest of the ridge. And for obvious reasons, it must be seated firmly. To seat the impression firmly is a simple matter of applying adequate pressure, if the tray is properly shaped. In a flat mouth, special care must be exercised to get every skeletal detail.

it, 2 mm. deep. The whole is chilled, until cold through and through. The surface is heated by dipping the face of the impression into boiling water for two seconds. Then the impression is inserted in the mouth and seated evenly and firmly on the mandible; chilled in the mouth and removed.

The impression is examined carefully to be sure that it extends at least 2 mm. beyond the distal point of the retromolar triangle; that it is molded well over the distobuccal area, and that it has completely displaced the buccal fold. We must be certain also that the mylohyoid ridge has been registered and that the

impression has a depth of at least one-fourth inch below it. Finally, the compound is carried to all the flexion lines. If the impression is defective in any of these respects, the faulty part is dried and a little warm compound is added to it. Then, as before, the whole is chilled, and the surface heated, and the impression is reseated, chilled in the mouth, removed and reinspected. Should the first impression satisfy the requirements, it is not necessary to take a second impression. The impression is now poured in plaster and separated.

Marking the Outlines for the Tray.—For the benefit of the laboratory assistant, a soft lead pencil is used to mark the outline for the tray on the plaster model.

The extreme distal point of the tray will be 2 mm. back of the distal point of the retromolar triangle. Proceeding lingually from this point, we draw a convex curve down and forward to the apparent flexion line on the cast, and then along or slightly above it, until an extreme low point is reached in the region of the first and second molars, approximately 3 mm. below the mylohyoid ridge. This will be the extreme low point of the tray, and it will be on the apparent flexion line of the floor of the mouth. This brings us to the area of the second bicuspid. From the second biscuspid on the right to the second bicuspid on the left, the flexion line of the floor of the mouth is followed to the area of the first and second molars. From there to a point 2 mm. back of the retromolar triangle, a curve is drawn similar to that on the opposite side. Proceeding buccally from this point, we draw a slightly curved line directly to a point about 2 mm. beyond the beginning of the external oblique ridge. Here, the line is curved sharply forward and the buccal flexion line followed to the second bicuspid. This will probably pass about 2 mm. beyond the buccal side of the external oblique ridge. From second bicuspid to second bicuspid, the labial flexion line is followed. Then the line is extended to the point behind the retromolar triangle as on the other side. These outlines will probably leave the tray somewhat overextended in almost every direction.

MAKING THE TRAY

In practice, these steps will be performed by the assistant. The "trubase" is rolled in three thicknesses: single, one and a half and double. Since I started reinforcing trays (step 7), I have used the single thickness for the lower. The flanges of a tray made from this thin material are easier to mold to place.

Shaping the Blank to the Model.—The plaster model is covered with petrolatum, the excess wiped off and the model placed on the bench. A blank of single thickness composition is laid on it, and the flame of a lighted bunsen burner is played over the composition until it wilts on the model. Then, with moistened paper tissues, the wilted composition is patted firmly to place. While still slightly warm it is removed from the model and the obvious excess is cut off with shears, and saved for use in reinforcement.

The composition is returned to the model, having been warmed if necessary, and again patted firmly with moist paper tissues and pressed hard enough to be adapted thoroughly to all the slight variations in the contours of the model, chilled thoroughly and removed. The composition has now taken form as a tray. With a No. 29 file attachment on the lathe it is filed to the exact lines marked out on the model.

Reinforcement.—The tray must be reinforced so that it is perfectly rigid and cannot be warped. It is returned to the plaster cast and, with a soft lead pencil, a line is marked all the way around it at least one-quarter inch in

from the periphery. The excess composition sheared off previously is heated with a mouth blow-torch and the reinforcement of the ridge is built on with a hot spatula. The reinforcement should rise on top of the ridge to a crest about one-quarter inch deep and should slope evenly away in all directions to the pencil mark. The space beyond the pencil mark must be left clear of reinforcement in order that the flange of the tray may be molded freely when the tray is fitted in the mouth later on.

Lastly, a handle is placed on the right side of the tray midway between the median line and the heel and the periphery is smoothed off so that there will be no sharp or jagged edges to abrade the lips.

Where the model has a perceptible undercut, the tray will not come off without distortion. In such case, the model is cut in the middle, when it will come apart readily. The model is preserved until the case is finished.

TRIMMING, FITTING AND SHAPING TRAY IN MOUTH

The object of these steps is to trim and mold the tray until it is stable in itself and has a perfect atmospheric seal.

Trimming Tray to Correct Outline.—(a) Trimming the outer flange: In trimming the outer flange of the tray, one simple rule can be followed without exception: The flange is trimmed until it just contacts the flexion line. The flexion line is followed as it actually exists when the cheek or lip is held according to directions. Where there are hollows, the edge of the flange should dip in constant contact with the tissues. Where attachments or frenums are visible, the edge should follow in bare contact around and over them.

We start by trimming the distobuccal position on the right side; insert the tray in the mouth and, with the thumb and finger of the left hand, hold the cheek straight up, firmly. Wherever the tray impinges on the tissue of the cheek, the edge is marked with a lead pencil and trimmed until it just touches the tissues at the flexion line. As we reinsert the tray after trimming and our hold on the cheek is released, the buccal fold should drop over the flange, to make a seal. Next, the left distobuccal portion is trimmed, and then the molar and bicuspid regions, in the same manner, the cheek being held as before.

In the labial region the lip is drawn out gently while we mark the flange for trimming. In "flat mouths" especially, we barely lift the lip. In such cases, the lip alone makes the seal.

(b) Anterior lingual flange: Next, we trim the lingual flange from bicuspid to bicuspid. With the tray in the mouth, the tip of the tongue is touched with the mouth mirror. The tongue immediately drops back and the floor of the mouth is in "low" position. The flange is shortened a millimeter at a time, until it follows the floor of the mouth a uniform 2 mm. above the floor when thus in "low" position, dipping for hollows and rising for attachments. The reason for following the floor of the mouth so exactly is the same as that for maintaining the outer flange in constant bare contact with the outer flexion line. In the normal position of the tongue, the floor of the mouth rises into contact with this part of the flange and plays over it. (For trimming this area in a "flat mouth," special directions are given under "Molding Tray to Mandible" (b).

In following the directions for trimming given here and at other points, dentists who are familiar with the Fournet-Tuller technic may fear that they are leaving the tray overextended. This is not the case. The denture, because it is fitted to close contact with the mandible, can be extended somewhat farther than would otherwise be possible, with consequent improvement in

stability and with less abrasion of tissue. This is the case because the muscles are held firmly in place and operate from the edge of the denture very much as from a new attachment, instead of sawing back and forth across the edge as they do when the denture stands away from the jaw.

(c) Distolingual flange: This area is left as trimmed on the plaster model until the wax impression is muscle-molded. The behavior of the wax will then indicate all further trimming necessary.

(d) Heels: The mouth mirror, held upside down, is allowed to slide back over the retromolar triangle until the edge of the mirror drops into a groove or depression, which is marked with an indelible pencil. Another mark is made 2 mm. back of the first. The tray is inserted and shortened until it just exposes the last mark. From this extreme distal point of the tray, the lingual flanges should curve anteriorly, as previously described under "Marking the Outlines for the Tray." Between this point and the cheek, the tray is trimmed on a line drawn almost at right angles to the main body of the tray. The corner where this line intersects the flexion line of the cheek is rounded off.

Molding Tray to Mandible.—As yet, the tray stands away from the jaw in many places and has no atmospheric seal. During this step, the flanges will be first heated and then ironed to place against the tissues. The object of the step is to bring every millimeter of flange into perfect contact with the millimeter of tissue which lies under it, whatever its contours. When the step is completed, the tray should have a perfect atmospheric seal and complete stability.

The following instructions apply throughout this step:

1. Heating: Heat the flange with a mouth blow-torch just enough to make it pliable. Do not overheat, or the flange will sag out of shape. Never heat more than 2 inches of the flange at a time. Do not heat the main body of the reinforcement. To do so causes warping. When molding an area adjacent to an area already molded, overlap the previous area or areas slightly in heating and molding the new area.

2. Molding: Insert the tray in the mouth and hold one side of the tray down firmly while the assistant holds down the other. Then wet the forefinger of the other hand and rub the heated portion of the flange rapidly and firmly to place. As soon as it seems thoroughly adapted to the tissue, have the assistant, using her free hand, chill it with water from a syringe. Do not stop rubbing until chilling is completed.

3. Inspecting trimming: As soon as an area is molded, inspect it to see whether the trimming remains correct. Should the flange still be too long or deep, trim further as directed in the previous step. Should you have overtrimmed, build out to the correct line with beeswax as directed under "Testing," and iron the beeswax edge to place at once.

(a) The outer border: First, mold the two distobuccal flanges, then the right and left bicuspid areas, and finally the labial, from cuspid to cuspid.

(b) The anterior lingual flange: Start the molding of the lingual flange with the anterior lingual area. Where the ridge has been entirely absorbed, trimming and molding present special problems. In such a case, the lingual flange must be trimmed just short of the two salivary ducts lying on each side of the lingual frenum. Never cover these ducts as it will irritate and infect them; and, in molding, iron the flange into perfect adaptation with the part of the floor of the mouth thus covered.

Where the ridge is normal, the anterior lingual flange presents no special problems. If the ridge is unusually high,

crook the forefinger and iron the flange to place with the end of it. Then take a lamp and small mouth mirror and examine carefully under the edge of the periphery to be sure that perfect contact has been established at all points.

(c) Distolingual areas: Next, mold the right and left distolingual areas. The distolingual area is the sole exception to the rule that the whole flange must always be ironed to firm contact with the tissues beneath, because this flange extends down over a deep undercut. The proper rule is to use as much of the undercut as possible and still reinsert the tray without serious difficulty. Over the mylohyoid ridge, however, the flange is ironed into perfect adaption.

If the distolingual portion is properly trimmed, turning the denture under the mylohyoid never abrades the tissues. Abrasion and soreness occur rather from failure to turn the distolingual flange of the denture under sufficiently. The more the distolingual flange can be turned into the undercut, out of harm's way, and withdrawal and reinsertion of the denture still be permitted, the less will be the interference of this flange with the muscles of the throat and tongue.

(d) Heels: Heat the right heel, overlapping the adjacent areas slightly, and reseat the tray. Then come down several times on the heel with thumb and forefinger closed against each other, allowing their pressure against the heel to force them apart, thus ironing the heel buccally and lingually at the same time. This pressure molds it perfectly. Complete by treating the left heel in the same manner.

Testing.—As we carry out the previous step, the tray will be unseated and reseated many times. Each time the tray is reseated, a careful watch must be kept for the appearance of air bubbles pushing out from beneath the portion of the periphery already molded. The appearance of such a bubble means that there has not been a complete adaptation of the tray to the tissues and that there is a consequent leak. Such a portion of the tray is reheated and remolded. The assistant should also watch for bubbles. She is on the other side of the chair and will see leaks that might otherwise be missed.

As soon as the molding of the heels is completed, the tray should be perfectly stable and have a perfect atmospheric seal. The seal is tested by pulling on the handle, which is on the right side of the tray. First, we pull hard to the patient's right. This will loosen the left heel of the tray if the seal is not perfect. Second, we pull the handle directly forward. This tests the right heel. Third, we push directly back on the handle. This tests the entire anterior portion, both labial and lingual. Lastly, we pull up on the handle and make any other tests desirable. If the flange resists all of these tests, it is properly molded. If not, there is some failure of the seal; which can have only two causes: trimming the tray too short and the presence of leaks, caused by failure to mold the periphery entirely to place.

Where the tray has been overtrimmed, it will come away very abruptly in the overtrimmed area. Any overtrimmed portion is extended by building on beeswax. First, we build it out for the approximate distance that it should extend, letting it overlap the tray on the outside to give it strength. Then, we soften the wax to a molding state with the mouth blow-torch, reseat the tray in the mouth and mold the wax to place according to the directions for molding the area involved; trimming if necessary.

When an area breaks loose during testing, we make a correction before testing further. If the failure is not caused by overtrimming, it will be the result of a leak due to incomplete molding. The leaks will be evidenced by air bubbles at the periphery, as already pointed out. Therefore, we go carefully around the

indicated portion of the periphery with lamp and mouth mirror, slightly raising and then slowly reseating the tray frequently, to look for telltale bubbles. Wherever we find one, we reheat and remold as instructed. We must not depend on the impression wax to fill leaks, because it will not.

TAKING THE WAX IMPRESSION

The impression medium here is the impression wax recently perfected by Dr. Dirksen, of the State University of Iowa, and it is this wax which makes the present technic possible. Necessarily, the tray, when molded in the manner just described, is brought to bear with unequal pressure on the tissue in the different areas. Unconsciously, we have pressed harder in some areas than in others. However, with this wax, which slowly creeps under pressure at mouth temperature, it is possible to correct all inequalities and to cause the tray, and thus the denture, to bear with the same relative pressure on all tissues alike, hard and soft.

To melt the wax for use, some of it is shaved into a medium size cupcake pan and the pan is placed in the top of an electric baby-bottle warmer, which can be purchased at any drugstore. In this device, the heat comes from boiling water, as in a double-boiler, and the water is heated by passing electricity through it. The wax should never be heated over an open flame since this causes a precipitate which changes the impression qualities of the wax unfavorably.

Equalizing Pressure Over Hard and Soft Tissue.—The tray is thoroughly dried with compressed air. Then, with a camel's-hair brush, the entire inside of the tray is painted with a thin even coat of the melted wax. This coat is carried out over the periphery and up the outside of the flange for one-quarter inch. The entire surface must be thoroughly covered, because, wherever a spot is missed, saliva will creep under the wax and cause it to peel off.

After the tray has been properly coated, it is chilled thoroughly with tap water and inserted in the mouth. Now, a strong even pressure is exerted on the tray for about two and one-half or three minutes by continuous ironing from *front to back* with the thumbs. The tray is chilled in the mouth with cold water, removed and dried thoroughly with paper tissues and compressed air. Spots will be seen, and then inspected carefully where the wax has appeared through to the composition. These spots are disregarded for the moment. Other spots will be seen where the wax has not touched the tissue at all. These will still be dull, as the wax was when first painted on. These dull spots are again painted with liquid wax. Then the entire interior and periphery are covered with an even coat of wax, as before. The spots that have not yet been in contact with the tissue will thus have an extra coat.

The impression is now chilled and reseated, as before, with the same pressure for at least the same length of time, and longer if necessary, until the wax starts to creep out under the edge; when it is chilled, withdrawn and dried. Incidentally, the seal is broken so that the tray can be withdrawn by drawing the patient's lower lip down firmly.

We now examine the tray for bare spots. The more accurate the molding of the tray, the fewer spots there will be. Wherever we find a bare spot, composition is ground off with a sharp bur, and also a little on all sides of the bare spot. We should not miss a single spot. The dust and chips are cleaned off with compressed air. The next step is to look for spots where the wax still fails to contact the tissue, and paint them separately as before. Again, the entire impression is given a coat of wax, with

two extra coats on the outside of the periphery as a start toward a peripheral roll.

The impression is now chilled and reseated, the same pressure being exerted for the same length of time. We again withdraw and look for bare spots and spots which have failed to contact. If there still are any such spots, we deal with them as before, keeping the overall coat of wax very thin, however, and repeating the process until the interior is uniformly smooth and glossy. Then, and only then, is the pressure thoroughly equalized.

Muscle Molding Peripheral Roll.—The periphery should be built to a thickness of about 3 mm. After a thorough drying it is given successive thick coats of wax until this thickness is reached. The purpose of thus thickening the edge into a roll is to keep the denture from cutting into the tissues. And the purpose of muscle molding this roll is to assure an adequate provision for all common muscle movements.

First, we reinsert the tray in the mouth and leave it there for two minutes. Then the patient is requested to close his lips and move them in all directions. If there is a heavy labial frenum, this movement is supplemented by taking hold of the lower lip with the thumb and forefinger and drawing it out and up. Thus molded into the periphery will be a provision for every moment that it is possible for the lower lip to make. Now, without removing the tray, the patient is instructed to moisten the lips thoroughly. This molds the two distolingual areas and also the anterior lingual area. The impression is now chilled in the mouth and removed.

If the flange is too deep or too long in any of these areas, the pressure will have cut through the wax and bared the edge of the tray. If so, not more than a millimeter is trimmed off the edge at the spots indicated. Then the peripheral roll is rebuilt and the impression tried again. If the flange is still too long, which is unlikely, the procedure is repeated.

Now the tray is inserted cold, and the patient is instructed to put his tongue in the left cheek; which molds the right bicuspid region. The tongue should be held in this position for one minute, when we again chill and remove the impression. If the edge is bared, it is trimmed as before, the peripheral roll rebuilt, and the trial repeated. The same is done for the left bicuspid region by having the patient put his tongue in his right cheek. The impression should now be completed.

CONCLUSION

1. A good impression, and a good denture, must bear on every square millimeter of tissue beneath it with the same force. The pressure must be equalized. Once the pressure is equally distributed, there is no spot where it is great enough to harm the tissues.

2. With this technic, there is no mouth, regardless of its peculiarities, which cannot be fitted with a perfectly stable denture.

THE DISPARITY BETWEEN DENTAL NEED AND DENTAL CARE IN SCHOOL CHILDREN OF HAGERSTOWN, MD., AND ENVIRONS

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DURING the period 1937-1939, a total of 6,257 white children attending the elementary and high schools of Hagerstown, Md., and environs had dental examinations. Several analyses based on these observations have been described.[1-18] The present report gives, mainly in tabular and graphic form, findings as to the disparity which exists between the development of dental need and the provision of dental care in this population group.

The number of boys and girls examined and their age distribution are given in Table 1.

THE PERMANENT TEETH

The number of DMF permanent teeth (teeth which had been attacked by caries#) and the number of these teeth which were found per child of the single chronologic ages are given in Table 2. Children 6 years of age show an average of nearly 0.3 of a DMF tooth and approximately 0.04 of a filled tooth. At this age, the number of teeth extracted and indicated for extraction¶ is negligible.

With advancing chronologic age, permanent teeth not previously attacked are attacked. As shown in Table 3, the rate of attack (DMF teeth per person per year) is for all ages approximately 0.7 of a permanent tooth per child per year of grade and high school attendance. The teeth are filled at a rate of about 0.25 of a tooth per child per year. More than 0.2 of a permanent tooth is extracted and indicated for extraction per child per year, and a residuum of more than 0.2 of a carious permanent tooth remains awaiting treatment by filling per child per year.

These data on the yearly incidence of DMF teeth and the yearly incidence of filled teeth are shown graphically in the lower section of Figure 1. Here is shown the striking and, for most of the age groups, the consistently maintained disparity between the yearly incidence of DMF and filled teeth. The upper section of Figure 1 shows how the yearly increments of DMF teeth and of filled teeth accumulate with advancing chronologic age.

The yearly disparity is measured as the arithmetic difference between the number of teeth which become DMF

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#Teeth that have been attacked by caries are designated as DMF teeth. This symbolism refers to teeth: carious (requiring fillings), filled, extracted and indicated for extraction. A tooth both carious (requiring filling) and filled is counted as one DMF (decayed, missing or filled) tooth.

¶In order to minimize the subjective decisions involved in determining what teeth should be indicated for extraction, only teeth without crowns, that is remaining roots, were so considered.

per child per year (the black columns in the lower section of Figure 1) and the number of teeth filled per child per year (the columns of small black squares in the lower section of Figure 1). The cross-hatched columns appearing in the lower section of Figure 2 give the magnitude of this yearly disparity. Since a disparity is found at practically all ages, it follows that it accumulates as age advances. The magnitude of this accumulated disparity is given for each age

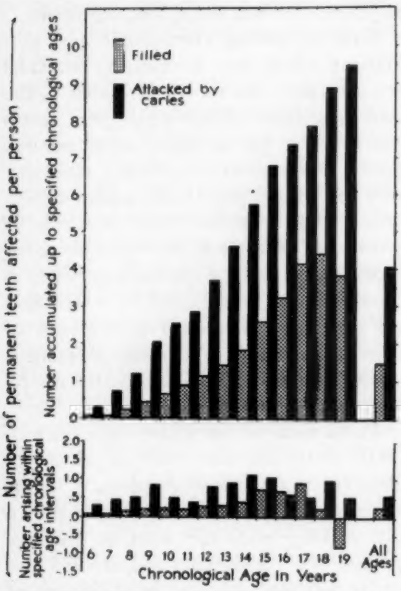
Number of permanent teeth affected per person
Number accumulated up to specified chronological ages
Filled
Attacked by caries
Number arising within specified chronological age intervals
Chronological Age in Years
All Ages

Fig. 1.—Lower section: Number of permanent teeth that become DMF per child per year; number of permanent teeth filled per child per year. Upper section: Number of DMF permanent teeth that accumulate up to particular chronologic ages, and number of filled permanent teeth that accumulate up to particular chronologic ages. (Data in Figures 1-6 derived from examination of 6,257 elementary and high school children of Hagerstown, Md., and environs.)

by the heights of the cross-hatched columns shown in the upper section of Figure 2.

It is clear that the disparity may be avoided now in only two ways: by filling carious teeth and by extracting carious teeth. The black columns appearing in the lower section of Figure 2 show that actually a considerable portion of the yearly disparity of teeth is extracted or becomes indicated for extraction per child per year. The heights of the black columns shown in the upper section of this figure give the numbers of extracted teeth and those indicated for extraction

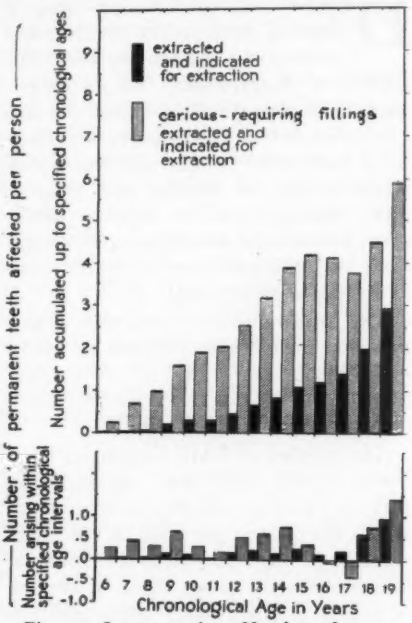
Number of permanent teeth affected per person
Number accumulated up to specified chronological ages
extracted and indicated for extraction
carious-requiring fillings extracted and indicated for extraction
Number arising within specified chronological age intervals
Chronological Age in Years

Fig. 2.—Lower section: Number of permanent teeth (carious) requiring fillings, and number of permanent teeth extracted and indicated for extraction per child per year; ~~number of permanent teeth extracted and indicated for extraction per child per year~~. Upper section: Number of permanent teeth (carious) requiring fillings and extracted and indicated for extraction accumulated up to particular chronologic ages; number of permanent teeth extracted and indicated for extraction accumulated up to particular chronologic ages.

which have accumulated up to the given ages.

These findings are summarized in Figure 3. The uppermost border of the

entire area represents the number of DMF permanent teeth that have accumulated up to the given chronologic ages. The area as a whole therefore represents the total number of DMF teeth that have accumulated in the school population of 6,257 children from the ages of 6 to and including 19 years.

The total of DMF teeth which are found as filled teeth is represented by the area shown in small black squares. The remaining portions of the whole area represent the numbers of DMF teeth which have not received treatment by filling. The area covered by vertical lines gives the number of DMF teeth which can yet be filled, while the area in black represents the number of teeth that have been extracted because of caries. The area covered by small black dots appearing immediately above the black area represents the carious teeth indicated for extraction. Thus, of the permanent teeth which become DMF, approximately one-third are treated by fillings, one-third come to be indicated for extraction or are extracted and one-third remain carious, awaiting treatment either by filling or by extraction.

TABLE 1.—NUMBER OF ELEMENTARY AND HIGH SCHOOL CHILDREN OF HAGERSTOWN, MD., AND ENVIRONS WHO HAD DENTAL EXAMINATIONS*

	Chronologic Age (Years)†														
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
Boys	171	197	231	253	270	262	299	272	341	325	193	172	74	27	3,087
Girls	156	206	256	240	259	269	297	293	354	326	252	183	74	5	3,170
Both sexes	327	403	487	493	529	531	596	565	695	651	445	355	148	32	6,257

*Data arranged by specified age and sex groups.
†Last birthday.

THE PERMANENT TOOTH SURFACES

The number of DMF permanent tooth surfaces (surfaces attacked by caries)‡ and the number of these surfaces that have accumulated up to particular chronologic ages are given in Table 4. As shown in this table, children 6 years of age have an average of nearly 0.4 of a DMF permanent tooth surface. At this age (6 years), approximately 0.05 of a filled surface is found per child.

With advancing chronologic age, tooth surfaces are newly attacked by caries. As is shown in Table 5, the incidence of caries attack on the surfaces for all age groups is of the order of 1.8 DMF surfaces per child per year of school attendance. The tooth surfaces are filled at approximately 0.4 of a surface per child per year. More than one tooth surface per child per year is involved in teeth extracted and indicated for extraction, and a residuum of 0.35 of a tooth surface per child per year remains carious and awaiting treatment. Accordingly, DMF permanent tooth surfaces develop per year at a rate nearly 5 times greater than the rate at which the surfaces are filled. This great disparity between the incidence of DMF and filled surfaces results each year in a steadily accumulating residuum of untreated carious surfaces. The average rate at which these untreated carious tooth surfaces accumulate can be seen to be of the order of 1.4 surfaces per child per year. On the average, of each 100 surfaces becoming DMF per year (over the interval from 6 through 19 years of age), approximately twenty surfaces are filled and nearly eighty surfaces remain un-

‡Tooth surfaces that have been attacked by caries are designated DMF surfaces. These letters refer to surfaces: carious (requiring fillings), filled and those surfaces presumed to have been attacked in teeth extracted and indicated for extraction.

TABLE 2.—TOTAL AND AVERAGE NUMBER OF PERMANENT TEETH AFFECTED BY SPECIFIED CONDITIONS IN 6,257 ELEMENTARY AND HIGH SCHOOL CHILDREN OF HAGERSTOWN, MD., AND ENVIRONS*

	Age (Years) Last Birthday														
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	All Ages (6–19)
	Number of Permanent Teeth														
Carious, requiring fillings (D)†	81	259	454	706	849	920	1,250	1,402	2,124	2,037	1,302	829	368	95	12,676
Missing (M)‡	1	11	25	90	156	163	275	375	572	698	537	503	297	94	3,797
Filled (F)	13	25	110	213	347	455	684	826	1,296	1,692	1,455	1,479	652	115	9,362
DMF ¶	95	293	583	994	1,329	1,510	2,179	2,573	3,907	4,322	3,193	2,743	1,290	296	25,307
Both carious and filled#		2	6	15	23	28	30	30	85	105	101	68	27	8	528
Remaining roots (extraction indicated)			4	26	26	26	65	62	96	113	67	53	31	5	574
Extracted	1	11	21	64	130	137	210	313	476	585	470	450	266	89	3,223
D+F	94	284	564	919	1,196	1,375	1,934	2,228	3,420	3,729	2,757	2,308	1,020	210	22,038
D+M	82	270	479	796	1,005	1,083	1,525	1,777	2,696	2,735	1,839	1,332	665	189	16,473
	Number of Permanent Teeth per Child														
Carious, requiring fillings (D)†	.2477	.6427	.9322	1.4320	1.6049	1.7326	2.0973	2.4814	3.0561	3.1290	2.9258	2.3352	2.4865	2.9688	2.0259
Missing (M)‡	.0031	.0273	.0513	.1826	.2949	.3070	.4614	.6637	.8230	1.0722	1.2067	1.4169	2.0068	2.9375	.6068
Filled (F)	.0398	.0620	.2259	.4320	.6560	.8569	1.1477	1.4619	1.8647	2.5991	3.2697	4.1662	4.4054	3.5938	1.4962
DMF ¶	.2905	.7270	1.1971	2.0162	2.5123	2.8437	3.6560	4.5540	5.6216	6.6390	7.1753	7.7268	8.7162	9.2500	4.0446
Both carious and filled#		.0050	.0123	.0304	.0435	.0527	.0503	.0531	.1223	.1613	.2270	.1915	.1824	.2500	.0844
Remaining roots (extractions indicated)			.0082	.0527	.0491	.0490	.1091	.1097	.1381	.1736	.1506	.1493	.2095	.1563	.0917
Extracted	.0031	.0273	.0431	.1298	.2457	.2580	.3523	.5540	.6849	.8986	1.0562	1.2676	1.7973	2.7813	.5151
D+F	.2875	.7047	1.1581	1.8641	2.2609	2.5895	3.2450	3.9434	4.9209	5.7281	6.1955	6.5014	6.8919	6.5625	3.5221
D+M	.2508	.6700	.9836	1.6146	1.8998	2.0395	2.5587	3.1451	3.8791	4.2012	4.1326	3.7521	4.4932	5.9063	2.6327

*Data arranged for the combined sexes by specified chronologic age groups.

†Includes teeth with active and arrested caries, but excludes teeth indicated for extraction.

‡Missing teeth include extracted teeth and teeth extraction of which was indicated.

¶In the DMF count, a tooth both decayed and filled is counted as one DMF tooth.

#In this group are included the teeth which contain fillings and which also show active caries, requiring fillings (teeth both decayed and filled).

‡In this group are included the teeth which contain fillings and which also show active caries, requiring fillings (teeth both decayed and filled).

TABLE 3.—YEARLY INCREMENTS (PER CHILD) OF PERMANENT TEETH AFFECTED BY SPECIFIED CONDITIONS

Permanent teeth affected by specified conditions	Age (Years) Last Birthday														All ages (6-19) ¶
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
	Increments and Decrements (Difference Between Age Specified and Previous Age) ‡														
Carious, requiring filling (D)	0.25	0.40	0.29	0.50	0.17	0.13	0.36	0.38	0.57	0.07	−0.20	−0.59	0.15	0.48	0.21
Extracted teeth and those indicated for extraction (M)	0.003	0.02	0.02	0.13	0.11	0.01	0.15	0.20	0.16	0.25	0.13	0.21	0.59	0.93	0.21
Filled (F)	0.04	0.02	0.16	0.21	0.22	0.20	0.29	0.31	0.40	0.73	0.67	0.90	0.24	−0.81	0.26
Attacked by caries experience (DMF)†	0.29	0.44	0.47	0.82	0.50	0.33	0.81	0.90	1.07	1.02	0.54	0.55	0.99	0.53	0.66

*Data derived from examination of 6,257 elementary and high school children of Hagerstown, Md., and environs, and arranged for the combined sexes by specified chronologic age groups.

†A tooth both decayed and filled is counted as one tooth attacked by caries. This procedure accounts for the fact that the yearly increments of DMF teeth do not equal in all instances the actual summation of the yearly increments and decrements of (D), (M) and (F) teeth.

‡Obtained by arithmetic differencing of the number of permanent teeth affected by the specified conditions per child at single successive ages. (Per child values shown in Table 2.)

¶Average annual increment obtained by dividing the summation of the increments and decrements of the several ages by the number of age groups.

TABLE 4.—TOTAL AND AVERAGE NUMBER OF SURFACES OF PERMANENT TEETH AFFECTED BY SPECIFIED CONDITIONS IN 6,257 ELEMENTARY AND HIGH SCHOOL CHILDREN OF HAGERSTOWN, MD., AND ENVIRONS*

	Age (Years) Last Birthday														
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	All Ages (6-19)
	Number of Permanent Tooth Surfaces														
Carious, requiring fillings (D)†	103	325	591	1,146	1,350	1,365	1,945	2,262	3,047	2,910	1,859	1,195	512	156	18,766
In missing teeth (M)‡	5	55	125	450	780	815	1,375	1,875	2,860	3,490	2,685	2,515	1,485	470	18,985
Filled (F)	17	27	122	273	452	591	945	1,103	1,756	2,339	2,068	2,162	954	168	12,977
DMF ¶	125	406	835	1,864	2,575	2,758	4,255	5,226	7,622	8,691	6,555	5,847	2,942	789	50,490
Both carious and filled#		1	3	5	7	13	10	14	41	48	57	25	9	5	238
In remaining roots (extraction indicated)			20	130	130	130	325	310	480	565	335	265	155	25	2,870
In extracted teeth	5	55	105	320	650	685	1,050	1,565	2,380	2,925	2,350	2,250	1,330	445	16,115
D+F	120	352	713	1,419	1,802	1,956	2,890	3,365	4,803	5,249	3,927	3,357	1,466	324	31,743
D+M	108	380	716	1,596	2,130	2,180	3,320	4,137	5,907	6,400	4,544	3,710	1,997	626	37,751
	Number of Permanent Tooth Surfaces per Child														
Carious, requiring fillings (D)†	0.3150	0.8065	1.2136	2.3245	2.5520	2.5706	3.2634	4.0035	4.3842	4.4700	4.1775	3.3662	3.4595	4.8750	2.9992
In missing teeth (M)‡	0.0153	0.1365	0.2567	0.9128	1.4745	1.5348	2.3070	3.3186	4.1151	5.3610	6.0337	7.0845	10.0338	14.6875	3.0342
Filled (F)	0.0520	0.0670	0.2505	0.5538	0.8544	1.1130	1.5856	1.9522	2.5266	3.5929	4.6472	6.0901	6.4459	5.2500	2.0740
DMF ¶	0.3823	1.0074	1.7146	3.7809	4.8677	5.1940	7.1393	9.2496	10.9669	13.3502	14.7303	16.4704	19.8784	24.6583	8.0694
Both carious (D) and filled (F)#		0.0025	0.0062	0.0101	0.0132	0.0245	0.0168	0.0248	0.0590	0.0737	0.1281	0.0704	0.0608	0.1563	0.0380
In remaining roots (extraction indicated)			0.0411	0.2637	0.2457	0.2448	0.5453	0.5487	0.6906	0.8679	0.7528	0.7465	1.0473	0.7813	0.4587
In extracted teeth	0.0153	0.1365	0.2156	0.6491	1.2287	1.2900	1.7617	2.7699	3.4245	4.4931	5.2809	6.3380	8.9865	13.9063	2.5755
D+F	0.3670	0.8734	1.4641	2.8783	3.4064	3.6836	4.8490	5.9558	6.9108	8.0630	8.8247	9.4563	9.9054	10.1250	5.0732
D+M	0.3303	0.9429	1.4702	3.2373	4.0265	4.1055	5.5705	7.3221	8.4993	9.8310	10.2112	10.4507	13.4932	19.5625	6.0334

*Data arranged for the combined sexes by specified chronologic age groups.

†Includes surfaces with active and arrested caries, but excludes surfaces of teeth indicated for extraction.

‡Missing surfaces include those in extracted teeth and in teeth indicated for extractions; multiplied by 5.

¶In the DMF surface count, a surface both decayed and filled is counted as one DMF surface.

#In this group are included the surfaces which contain fillings and which also show active caries requiring fillings (surfaces both decayed and filled).

‡In this group are included the surfaces which contain fillings and which also show active caries requiring fillings (surfaces both decayed and filled).

TABLE 5.—YEARLY INCREMENTS (PER CHILD) OF PERMANENT TOOTH SURFACES AFFECTED BY SPECIFIED CONDITIONS*

Permanent tooth surfaces affected by specified conditions	Age (Years) Last Birthday														All ages (6-19) ¶
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
	Increments and Decrements (Difference Between Age Specified and Previous Age) ‡														
Carious, requiring filling (D)	0.32	0.49	0.41	1.11	0.23	0.02	0.69	0.74	0.38	0.09	−0.29	−0.81	0.09	1.42	0.35
In extracted teeth and in teeth indicated for extraction (M)	0.02	0.12	0.12	0.66	0.56	0.06	0.77	1.01	0.80	1.25	0.67	1.05	2.95	4.65	1.05
Filled (F)	0.05	0.02	0.18	0.30	0.30	0.26	0.47	0.37	0.57	1.07	1.05	1.44	0.36	−1.20	0.37
Attacked by caries (DMF)†	0.38	0.63	0.71	2.07	1.09	0.33	1.95	2.11	1.72	2.38	1.38	1.74	3.41	4.78	1.76

*Data derived from examination of 6,257 elementary and high school children of Hagerstown, Md., and environs, and arranged for the combined sexes by specified chronologic age groups.

†A surface both decayed and filled is counted as one surface attacked by caries. This procedure accounts for the fact that the yearly increments of DMF surfaces do not equal, in all instances, the actual summation of the yearly increments and decrements of (D), (M) and (F) surfaces.

‡Obtained by arithmetic differencing of number of permanent tooth surfaces affected by specified conditions per child at single successive ages. (Per child values shown in Table 4).

¶Average annual increment obtained by dividing summation of increments and decrements of several ages by number of age groups.

filled, per year. Of these eighty unfilled surfaces, sixty are in teeth extracted and indicated for extraction, while only twenty remain in such condition that they warrant treatment by fillings. To express it in other terms: More than three-fourths of the permanent tooth surfaces becoming DMF per year remain without fillings; and of the latter, two-thirds extend to a point where therapeusis by fillings cannot be recommended. Thus, they are indicated for extraction or are extracted.

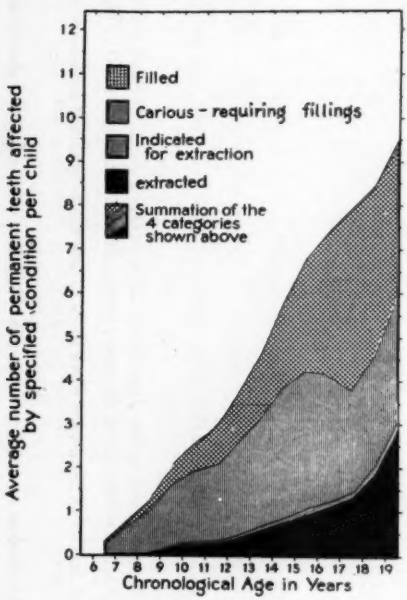
Average number of permanent teeth affected by specified condition per child
Filled
Carious - requiring fillings
Indicated for extraction
extracted
Summation of the 4 categories shown above
Chronological Age in Years

Fig. 3.—Chronologic age and number of DMF permanent teeth per child; number of filled permanent teeth per child; number of permanent teeth (carious) requiring fillings per child; number of permanent teeth extracted and indicated for extraction per child.

Further illustration of the disparity between dental need and dental care is given by the material shown in Figure 4. The upper section of this figure illustrates how the disparity between the yearly incidence of DMF surfaces and filled surfaces in successive ages (shown in the lower section) results in an accumulating residuum of unfilled carious surfaces. Thus, during the broad age interval 6 through 19 years, there is found, per hundred children, an average of 810 DMF permanent tooth surfaces, of which 207 are filled and 603 evidence no fillings. Of the last, 303 surfaces are in teeth indicated for extraction and in extracted teeth, and 300 surfaces are in a condition warranting fillings.

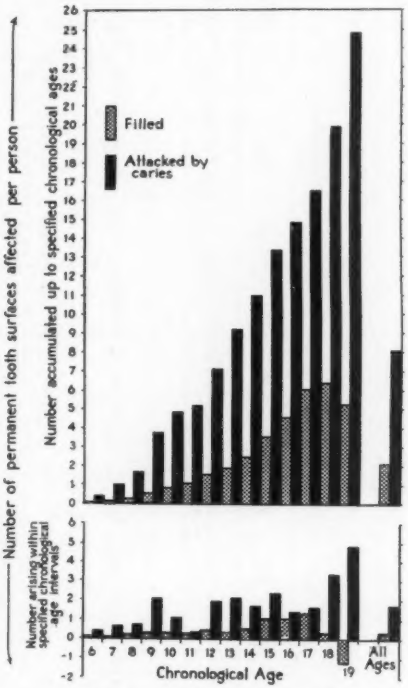
Number of permanent tooth surfaces affected per person
Number accumulated up to specified chronological ages
Filled
Attacked by caries
Number arising within specified chronological age intervals
Chronological Age
All Ages

Fig. 4.—Lower section: Number of permanent tooth surfaces that become DMF per child per year; number of permanent tooth surfaces filled per child per year. Upper section: Number of DMF permanent tooth surfaces that accumulate up to particular chronologic ages; number of filled permanent tooth surfaces that accumulate up to particular chronologic ages.

Accordingy, the average school child over the period covered by the ages 6 through 19 years shows a current need

for filling of about three permanent tooth surfaces, of the order of three surfaces lost, and a little more than two surfaces filled.

The magnitude of the yearly disparity of unfilled carious tooth surfaces and the accumulated disparity of these surfaces found at the different ages are shown, respectively, in the lower and upper sections of Figure 5. The material plotted in this figure also shows that more than half the accumulated unfilled carious surfaces are in teeth indicated for extraction or extracted.

The general findings with respect to the permanent tooth surfaces are summarized graphically in Figure 6. The whole area under the uppermost border of the black and spotted area represents the number of DMF tooth surfaces per child that have accumulated up to the given chronologic ages shown on the abscissal scale. Thus, the area as a whole represents the aggregate number of DMF tooth surfaces that have accumulated in the 6,257 children. The number of these DMF surfaces which have received treatment by fillings is shown by the area covered in the small black

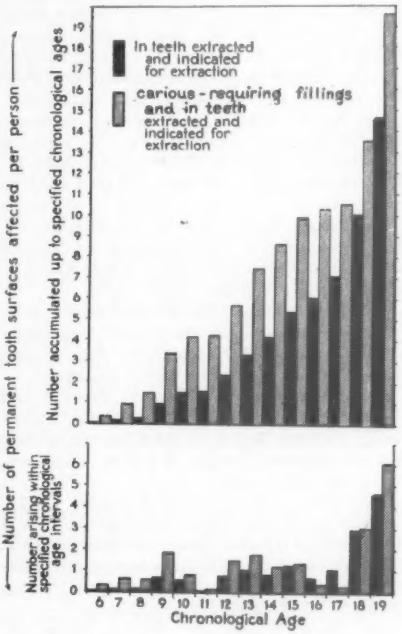
In teeth extracted and indicated for extraction
carious-requiring fillings and in teeth extracted and indicated for extraction
Number accumulated up to specified chronological ages
Number arising within specified chronological age intervals
Number of permanent tooth surfaces affected per person
Chronological Age

Fig. 5.—Lower section: Number of permanent tooth surfaces (carious) requiring fillings and lost in teeth extracted and indicated for extraction per child per year; number of permanent tooth surfaces lost in teeth extracted and indicated for extraction per child per year. Upper section: Number of permanent tooth surfaces (carious) requiring fillings and lost in teeth extracted and indicated for extraction accumulated up to particular chronologic ages; number of permanent tooth surfaces lost in teeth extracted and indicated for extraction accumulated up to particular chronologic ages.

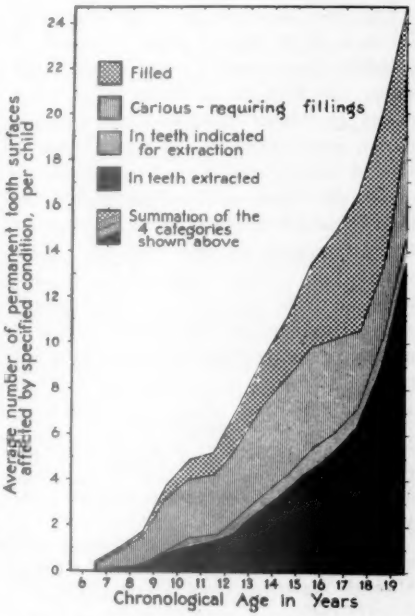
Filled
Carious-requiring fillings
In teeth indicated for extraction
In teeth extracted
Summation of the 4 categories shown above
Average number of permanent tooth surfaces affected by specified condition, per child
Chronological Age in Years

Fig. 6.—Chronologic age and number of DMF permanent tooth surfaces per child; number of filled permanent tooth surfaces per child; number of carious permanent tooth surfaces requiring fillings per child, and number of permanent tooth surfaces lost in teeth extracted and indicated for extraction per child.

squares. The remainder of the whole area represents the number of DMF surfaces which have not been treated by fillings. The latter area forms about three-fourths of the DMF surfaces and, as shown in this figure, about one-half of these unfilled DMF surfaces are in the extracted teeth and in the teeth indicated for extraction.

On the basis of these findings, the solution of the dental problem in school children clearly would involve two main steps, the first an attempt to so treat caries in school children that no disparity would exist in the rate of provision of fillings and the rate of attack by caries. We have outlined an "eight-year plan,"[6] which is designed to implement the attainment of this objective. Obviously, the second step, which is now being actively pursued in many laboratories, involves the search for ways and means of preventing the initiation of caries.

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THE INFLUENCE OF HEAT TREATMENT ON PARTIAL DENTURE STRUCTURES

By Floyd A. Peyton,* Sc.D., Ann Arbor, Mich.

LIKE most other dental restorations, the finished removable partial denture is an accumulation of unit technics which can all work together for either constructive or destructive results. Carefully controlled heat treatment of the structure represents only one step in the sequence of construction. Properly carried out, the heat treatment of partial denture gold alloys presents the possibility of definite improvement of the structure in service. Heat treatment can thus eliminate one uncertainty in the process of construction. To disregard this operation or to perform it carelessly is not only unscientific, but also tends to uncertainty in the behavior of the alloys being used. On this basis, it appears to be a justifiable step in practice to include heat treatment with the numerous other technics of construction, to insure more satisfactory results. The theme of this discussion, therefore, is the modification of properties in gold alloys and the possible improvement of partial dentures by the use of controlled heat treatment.

It is unfortunate that the expression "heat treatment of gold alloys" has, in some instances, come to be regarded fearfully by some members of the profession, and by others with considerable skepticism. Too often, it seems to imply a tedious or laborious operation of little or no end significance. This viewpoint often appears to have developed as a result of some unfortunate experience involving unnecessarily expensive equipment, improper or inadequate treatment of some specific alloy or the mishandling of the case throughout its preparation, so that heat treatment aggravated the case rather than improved it. This should not be considered the prevailing situation.

EXPLANATION OF THE TERM "HEAT TREATMENT"

The scientific heat treatment of partial denture gold alloys implies the use of definite and controlled temperature conditions to develop the mechanical properties most suitable to the intended purpose of the structure. Unfortunately, there has not been enough attention given to the temperatures to be used on the many alloys available or to the physical and mechanical properties essential to satisfactory denture construction. These are subjects for future development.

Regardless of whether the operator wishes to intentionally heat treat the structure, there will be a modification of properties during its preparation because of heat applications. It should be kept in mind that, as soon as the blowpipe is applied to the metal for melting, the properties are being destroyed which the manufacturer put into the alloy as it was produced. From that time, the nature of the alloy and its behavior in the finished case is entirely in the hands of the operator.

Particularly important in modifying the properties of the cast denture is the rate of cooling the casting in the flask. If plunged into water soon after the

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metal has solidified, the alloy can be easily bent and adapted without great fear of breakage from brittleness. It will, however, probably not have sufficient resistance to bending to be of service in the mouth unless it has been designed with excessive bulk.

If, however, the same alloy is cast into a very hot mold and allowed to cool slowly in air on the bench top or under some protecting cover, it may require thirty or more minutes to cool to room temperature. This treatment will, in general, produce a rigid structure, not capable of adjustment without danger of fracture from brittleness. Under these conditions, there is little doubt that the structure has plenty of strength to withstand the stresses of mastication, but it is dangerously brittle for practical usage because of the danger of fracture from unusual stresses, such as dropping.

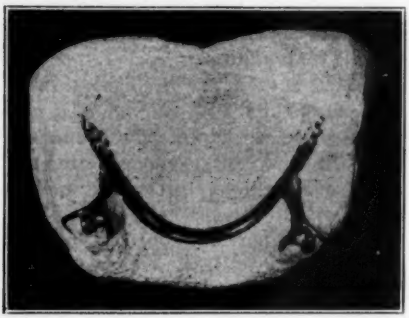

Fig. 1.—Investment tray to support denture while heating.

The whole problem in the cases just cited becomes more complicated if a soldering operation on either a major or minor section of the structure has been necessary. In soldering a clasp attachment, for instance, there is an area surrounding the junction that is heated to redness. This spot may then have been quickly or slowly cooled. Even though the whole case originally may have been so treated at the time of casting as to develop the maximum properties in the structure, a later soldering operation, followed by slow cooling, will have changed the structure in this particular area. As a result, it is possible that the most critical stress-bearing portion of the case has undergone severe mistreatment, permitting possible fracture in service.

Such an instance of unintentional heat treatment serves only to illustrate the uncertainty of results to be expected if no controlled heat treatment is later undertaken. It shows how the properties of the finished structure can be influenced by the inadvertent use of heat during construction of the case. It seems only logical and correct, therefore, that some means of controlled heat treatment should be correlated and integrated into the practice of better partial denture construction. Without such a plan, there seems to be no control of the stresses that may be induced in the supporting tissues, both hard and soft, or means to estimate the life or service the restoration will render before failure.

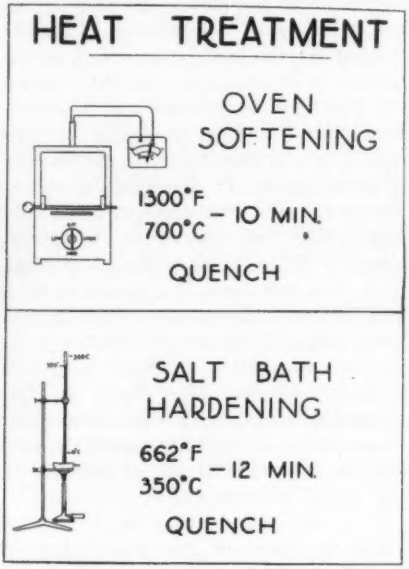

Fig. 2.—Equipment for heat treating gold alloys.

It has now been shown repeatedly that alloys containing gold and appreciable amounts of copper, platinum and palladium are hardened when heated to temperatures just below redness for a short time before quenching in water. This hardening operation is accompanied by an increase in strength and also an increase in brittleness.

The same alloys are softened by being heated to redness (1300° F.) and quickly cooled to room temperature by plunging in water. This softening is accompanied by a decrease in strength and a loss of brittleness. The change in properties from the softened to the hardened condition or back again is accomplished by

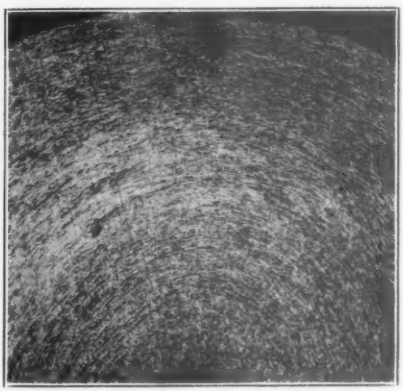

Fig. 3.—Severe bend in wire showing area in tension.

a rearrangement of the atoms of copper and gold, platinum and palladium in the solid state.

It is an interesting fact, and one that is often not appreciated by the operator, that an alloy can be arbitrarily, but definitely and repeatedly, changed from the softened to the hardened condition and back again simply by quenching after heating to the specified temperatures. The inherent nature of the casting need not be appreciably affected by this action. Only the strength that it maintains and the brittleness that it possesses are changed.

In the complete sense of the term, therefore, heat treatment consists of two distinct operations. The first is a softening, or annealing, operation, while the second is a low temperature hardening, or strengthening operation. These procedures are entirely different, both as to the manner performed and as they influence the internal structure and properties of the alloy.

Reason for Softening the Case.—During the assemblage of the denture, some sections may have been heated for soldering or adapting, while others were not. Other portions may have been bent and adjusted with pliers without being annealed. Both operations change the original properties of the alloy and make it non-uniform throughout the denture. This has already been illustrated in the discussion of unintentional heat treatment. If the alloy is then heated to 1300° F. (700° C.), or redness, in a furnace for ten minutes and immediately quenched, it becomes uniformly softened throughout its entire structure. The reason, therefore, for softening the denture after construction is completed is to achieve this uniformity of structure before subjecting it to the hardening treatment. If a non-uniformly softened denture is given a hardening treatment, it will remain non-uniform in hardness when the operation is completed, because the hard sections continue to increase in hardness, while the soft areas are also being hardened, but to a lesser extent.

Reason for Hardening Operation.—The softened case does not, in most alloys, possess sufficient strength and rigidity for use in practice. When heated for hardening, the case is also strengthened and made more rigid. Each alloy has some definite time and temperature condition that will develop the optimum properties of hardness, strength and rigidity. It is not the same for all alloys. As an example, to assure hardening, one

alloy must be heated for fifteen minutes at 662° F. (350° C.), while another alloy must be heated for twenty minutes at 450° F. (232° C) before being quenched. This information on the correct hardening time and temperature is available from the manufacturers of the various alloys, and should be followed for each product used. The object of the hardening operation is to produce a uniformly strengthened case with adequate properties to withstand the stresses of mastication. The hardening treatment follows immediately after the softening operation and just before the final polishing is done.

DATA ON PHYSICAL PROPERTIES OF DENTURE ALLOYS*

Name of Alloy	Condition	Percentage Elongation	Proportional Limit Lb./Sq. In.	Ultimate Tensile Strength Lb./Sq. In.	Brinell Hardness Number
Aurinite No. 2	Soft†	7.5	34,000	77,000	155
	Hard‡	0.4	92,500	112,500	245
Deethree	Soft	15.0	37,000	55,000	138
	D.U.#	4.0	75,000	92,000	184
	D.C.¶	2.0	78,000	96,000	190
	Hard	1.0	80,000	106,000	219
Jelenko No. 7	Soft	18.5	43,800	67,000	142
	Hard	2.0	82,000	103,500	230
Ney-Oro G-3	Soft	20.0	39,500	73,500	140
	Hard	4.0	72,000	111,000	225
Ney-Oro No. 6	Soft	15.0	58,000	90,000	160
	Hard	2.0	85,000	118,000	225
Paliney No. 3	Soft	4.0	49,000	85,000	155
	Hard	1.0	71,000	105,000	215
Spyco 4 L.F.	Soft	27.5	40,000	69,500	135
	15 min.—450°F.	5.0	64,000	93,000	185
	Hard	1.5	77,000	104,500	210
Sturdicast	Soft	26.0	38,600	66,000	135
	Hard	2.0	86,000	117,000	210
Tinker No. 4	Soft	15.0	41,500	74,000	145
	15 min.—475°F.	4.0	61,500	92,000	185
	Hard	1.3	71,000	105,500	215

*Available from manufacturers.
†Castings heated to 1300°F. and quenched in room temperature water.
‡Softened castings reheated to 840°F. and cooled slowly to 480°F.
#Heat treated in Dee unit with cover off, twenty minutes, 500°F.
¶Heat treated in Dee unit with cover on, twenty minutes, 600°-650°F.

METHOD FOR CONDUCTING CONTROLLED HEAT TREATMENT

Softening Operation.—Gold alloys can be softened by any means that permits heating to 1300° F. (700° C.) before quenching. This usually is most easily accomplished by the use of an electric furnace. The furnace preferably should be equipped with some form of temperature control and indicating device. Without a thermocouple and pyrometer, there is uncertainty about the degree of heat that the furnace may develop. Most wax eliminating, or burn-out, furnaces are so designed that they can be regulated to develop the necessary temperature. Any such furnace is entirely suitable for use in softening the partial denture. Thus, it is possible to use equipment for the softening operation that is available and essential for another step in the preparation; namely, wax elimination.

In order to give the denture uniform support during heating to redness, the

case may be supported on an investment tray as shown in Figure 1. The use of the investment tray prevents distortion from several possible sources. For example, when introduced into, and removed from, the furnace, it serves as a tray to be handled with tongs rather than by grasping the casting. The structure is uniformly supported by the investment so that the entire weight is not resting on a few points, thus preventing any possibility of warpage when heated to redness, a condition which might result if the tray is not used.

In a one-piece, non-assembled casting, wherein appreciable amounts of adjustment are unnecessary, it is possible to quench the casting in the ring as soon as the sprue button has turned black. The softening operation can thus be accomplished in this manner. It is to be remembered, however, that any such result is destroyed and uniformity throughout the structure is lost when the case needs to be reheated for soldering or other operations during assembly.

Method of Conducting Hardening Operation.—While it is impossible to properly harden an alloy by heating it in an open flame without some control of temperature, it is not essential to use elaborate equipment for this operation. Two general methods for hardening are in practice. One is to place the case in a furnace heated to 840° F. (450° C.), then cool to 480° F. (240° C.) in a specified time. The other is to heat to a definite temperature, by any convenient means, and maintain this temperature for a definite period. The first is the standardized practice for hardening gold alloys, American Dental Association specification No. 7, where it is called the "oven-cooled" condition and requires the use of a furnace and pyrometer.

The temperature may be developed by a furnace having a thermometer or thermocouple, but use of a furnace is not essential. The heating may be done by placing the denture in a liquid medium capable of being heated to the indicated temperatures. Such liquids as fats, oils or molten salts may be used for this purpose. It has been found that a mixture of 50 per cent sodium nitrate and 50 per cent potassium nitrate has a suitable melting point and can be heated to the desired temperature without decomposition taking place. Electrically heated units can be obtained for melting this mixture, or it may be melted over a Bunsen flame in a porcelain casserole. By using a thermometer with a scale range from 0 to 350° C. (660° F.), the molten salt can be maintained at the desired temperature, with but a small amount of flame regulation. The structure, which should be thoroughly dried, is placed in the molten bath at the recommended temperature for the desired time and then immediately quenched. It is then considered to have been hardened.

The hardening may also be accomplished by controlling the rate of cooling in the mold after casting. This method implies, however, that the operator will give special attention to the size of the mold and the time that it is allowed to cool. This practice eliminates the possibility of radical adjustment or soldering operations on the case, since such treatment would destroy the desirable properties developed through the controlled cooling.

Summary of Procedure for Softening and Hardening.—Figure 2 is a sketch of the equipment necessary and an example of the times used for the heat treatment of a partial denture. Mounted on the investment tray already described, the denture is placed in an electric furnace for ten minutes at 1300° F. (700° C.), after which it is removed and immediately quenched in water. The furnace is heated to 1300° F. before the denture is inserted. That is all that is necessary for the softening operation.

After quenching, the investment is removed and the denture is carefully dried. It is then placed in the casserole of molten salt, which has been heated to the temperature indicated for the specific

alloy being used. By regulating the gas flame, the temperature is maintained for the necessary time. This time will vary with the different alloys used, but it will be approximately fifteen to twenty minutes for most products. After heating for the desired time, the denture is again quenched in water. This constitutes the hardening operation. When both of these steps have been completed, the case is considered to have been heat treated under controlled conditions and is ready to be finished and polished, or is ready for the curing of vulcanite or resin saddles. The technic of heat treatment is thus a simple operation. The only requirements are that the correct times and temperatures be conscientiously maintained for the product employed.

If the foregoing procedure is conscientiously followed, there is assurance that the partial denture gold alloy will always have the same properties in the finished state, and essentially the same properties regardless of whether it is quickly or slowly cooled after casting. Likewise, many of the irregularities introduced during adjustment of clasps and soldering operations can be eliminated by this treatment. In other words, the structure presents more uniform mechanical properties when heat treated than when not. Since it is a definite physical reaction that takes place in the alloy to produce these changes in properties, the operator can be assured of obtaining uniform results in a series of appliances, provided the same alloy and the same treatment is used for each. Failures of a denture in practice may then be more readily traced to other sources, such as improper design, mistreatment of the alloy during melting or mishandling of the pliers during adjustment or manipulation. In other words, the administering of controlled heat treatment to the denture removes one possible source of error and allows for the detection of other causes of failure. In addition, it may aid in giving desirable qualities to the structure so that it may render better and longer service. It is to be remembered that controlled heat treatment is only one way to improve partial dentures. It does not correct all errors of construction.

SOME PROPERTIES FUNDAMENTAL TO DENTURE CONSTRUCTION

Since the properties of gold denture alloys can be controlled or modified by the application of heat, it is desirable to understand something of the nature of mechanical properties and to consider some of those that are essential to the measurement of quality in an alloy for partial dentures.

Three of the more important properties of removable partial denture alloys for the dentist to consider are: (1) the extent to which the alloy can be bent without permanent deformation, (2) the force required to cause permanent deformation and (3) the limit to which it can be bent without fracture. Considerable information on these properties can be obtained by an examination of values for proportional limit and percentage of elongation as supplied by the manufacturers.

Some mechanical properties of several dental gold alloys are given in the accompanying table. These properties have been assembled from manufacturers' physical property charts supplied to the profession. The various products are listed alphabetically. The table illustrates the most useful properties of the alloy.

With three alloys (Deethree, Spyco 4 L.F. and Tinker No. 4), the use of a temperature condition for hardening that is different from the over-cooled treatment is recommended. This seems to be a desirable practice, indicating that every partial denture alloy has a definite time and temperature of treatment that will develop properties to give a maximum of service. Although, by this practice, extreme values in one property may be sacrificed for the sake of another, there

results an alloy with more balanced properties.

Stresses Introduced During Bending.—When a structure is permanently bent or adapted to shape, a portion of it is subjected to tension. This is shown in Figure 3, in which a gold alloy wire has been bent to a sharp angle. The upper portion of the picture, or the outer portion of the bend, has been stretched to a point of fracture. The inner part of the bend, however, has been subjected to compression. Each time a denture clasp or any other portion of the structure is bent, it is subjected to tension or stretching in the outer part of the bend. Obviously, it is not always sufficiently severe to cause fracture.

A relatively good measure of the amount of bending, or more exactly the amount of stretching that can take place before failure occurs, is indicated by the percentage of elongation. Some alloys in the hardened condition can be stretched only 1.0 to 2.0 per cent before failure, while the same alloys in the softened condition can be extended 15, 20 or 25 per cent or even more without fracture. When the alloy can be stretched but a slight percentage, it is considered to be brittle. One is not considered brittle that has a high percentage of elongation. It is often said, therefore, both from practical observations and from physical test results, that an alloy in the hardening condition is brittle and clasps should not then be adjusted. In the softened condition, the alloy has a higher percentage of elongation, is not brittle and is in a condition suitable for clasp adjustment. Brittleness, therefore, is a kind of strength measurement in an alloy, and it is seen that the percentage of elongation represents to some extent a measurement for brittleness.

If an alloy can show at least 2 per cent and preferably 4 to 8 per cent elongation after heat treatment and still have sufficiently high proportional limit and ultimate strength values, it is generaly considered highly desirable for practice. With these properties, the appliance is not likely to fracture from dropping or possible distortion by patients during average use.

Resistance to Distortion.—The resistance of an alloy to distortion either in use or for adjustment purposes is not the same quality as brittleness. For example, it may require a great force to bend a structure, but as soon as this point is reached and the alloy is bent slightly, it may fracture because of brittleness or low percentage of elongation. Two distinct properties are therefore being considered. One is the force necessary to cause distortion or bending. The other is the amount of bending permitted by the alloy without breakage.

The resistance to permanent distortion is indicated by the proportional limit of the alloy. Sometimes, the more descriptive term "yield point" is used as a synonym for proportional limit. For practical purposes, either one is satisfactory and serves to indicate the point at which the structure yields to the stress that it has supported and thus becomes permanently distorted. If the proportional limit value of the alloy is high, a relatively great stress is required to permanently distort the casting. A clasp from such an alloy is not so readily adjusted as one with a low proportional limit. On the other hand, a structure from an alloy with a high proportional limit will resist permanent distortion in use better than if the proportional limit is low.

The proportional limit is therefore a danger point among physical properties. For partial denture work, an alloy with a proportional limit below 65,000 pounds per square inch in the oven-cooled condition is considered to be unsafe. It means that if the alloy is not heat treated, or is of such composition that it will not have more than 65,000 pounds per square inch value for proportional limit, the structure will not render the best service in practice. If the value is too low, the clasps or framework may open

and get out of adjustment in use so that readjustment becomes frequently necessary. This assumes, however, that the design was originally correct so that the structure is not so severely overstressed in normal use as to cause the distortion. If this situation continues, it is possible that a structure which is normally well supported by both hard and soft tissue may become either entirely tooth borne or soft tissue borne. This indicates that the structure has been loaded to the point where it has become permanently deformed. It is then no longer functionally correct. If an alloy with a higher proportional limit after heat treatment or one with greater stress resistance had been used, the failure would not have occurred.

A low resistance to distortion can be of advantage in making adjustments of clasps and framework. This is one reason that a denture is heated to redness and quenched before adaptation. As seen in the accompanying table, the proportional limit is relatively low in the softened condition, while the percentage of elongation is high. This means that the softened alloy can be readily adapted with a minimum of effort and without fear of breakage from brittleness.

Significance of Other Properties.—The Brinell hardness number and ultimate tensile strength are also listed in the table of properties for the alloys. These are perhaps of somewhat less direct significance as a measure of quality in partial denture alloys than are the proportional limit and percentage of elongation as discussed above.

The Brinell hardness of an alloy is of some interest in determining the resistance to abrasion, the ease of polishing and the ability to retain a brilliant surface after being finished. Minimum values allowable for Brinell hardness are about 130 in the softened condition and 200 in the oven-cooled condition. Values much below these apparently cannot assure satisfactory service in practice.

The Brinell hardness also gives some indication of the other properties of proportional limit and percentage of elongation which the alloy exhibits, although no direct relationship exists for all alloys. In general, a hard alloy has a higher proportional limit with a smaller percentage of elongation than a soft alloy. This may be seen by a comparison of the alloys in the hardened and in the softened condition in the table.

The ultimate tensile strength is primarily an indication of the stress supported at the breaking point of the alloy. In general, it is of less significance than the proportional limit because, in practice, a structure has failed when it has become permanently distorted. Actual rupture is therefore of less significance than distortion.

From the standpoint of design and construction, it is desirable to know whether the ultimate tensile strength value is appreciably higher than the proportional limit. If the two are very close together in value, when the structure is permanently distorted it will probably very soon fracture. This condition sometimes prevails in very brittle alloys or those with a low percentage of elongation. For safety in construction, it is considered that denture gold alloys should have a minimum value of 90,000 pounds per square inch in the oven-cooled condition.

Data regarding other properties of these alloys are sometimes supplied by the manufacturers. These include values for modulus of elasticity, torsion, fusion points, cold bending through 90 degrees and stiffness test results. These values are found useful in comparing alloys under controlled conditions. In general, however, they supplement the four fundamental properties of construction as discussed above. An understanding of these additional properties may be helpful, but they are possibly less essential than are hardness and the properties of proportional limit, percentage of elongation and tensile strength, determined during tension testing.

THE JOURNAL *of the*
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REHABILITATION

THE first results of the examination by the Selective Service Induction Boards of the draftees registered for military service in the present emergency revealed that an alarming number of young men were unavailable for military service because of physical defects. In fact, the number was so great that serious attention has been directed toward remediable measures on the part of the Selective Service System.

The number of men unavailable for full military service was equal to if not greater than the number disqualified in World War I, and there has been some criticism of the health agencies of the country in Army circles as well as among the civilian population for the condition of health of the youth of America.

Recent reports from the Selective Service System indicate that 42.6 per cent of all men examined by the draft boards have been rejected for physical defects; and of this group, 15.51 per cent have been rejected because of dental defects. In commenting on the figures, General Hershey, Director of the Selective Service System, said it was a condition of which we nationally should be ashamed; a condition that we should recognize as dangerous, and one that we should take immediate and

positive steps to correct. For dentistry, may we say that we are quite ashamed—to the point of chagrin and humiliation—not only of the alarming degree of dental disease, but also of the seeming failure of the educational efforts of the dental profession toward promoting mouth health.

We are faced with the fact that nearly one-half of the otherwise available fighting manhood of America is not fit for effective defensive service because of preventable physical defects; surely a situation that not only furnishes material for serious consideration, but one that demands our best concerted efforts for its correction.

Contemplation of these results not only is embarrassing and distressing from the standpoint of health, but also elicits considerable concern and anxiety from the standpoint of the needless effort and expense involved in operating the machinery set up for the selection of men for army service.

Not in any sense of offering an alibi for the dental profession but in an effort to explain, but not excuse, the deplorable condition of the mouths of the youth of the nation, we do not accept the implication that the conditions are entirely attributable to laxness of effort on the part of the dental profession in caring for the dental demands of the public or in endeavoring to sufficiently impress upon the public the desirability and necessity of mouth care as a general health measure. The dental profession almost from its inception has expended much effort toward mouth health education, and particularly in the last two decades, a period coeval with the intervening years of so-called peace, have we labored day in and day out to impress upon the public and the medical profession the desirability and necessity of care and prevention of oral diseases because of their definite causal relation to systemic diseases. Some progress has been made toward educating the public in this respect, and the reaction of the medical profession on the whole has been favorable toward recognition of the relation between oral and bodily disease, but the solution offered not only failed in its remedial objective, but also largely discounted the integrity of the health efforts of the dental practitioner—the principal remedial measure offered being extraction of teeth.

This procedure, as we now learn, is a poor substitute for preventive care of the mouth and teeth. And, incidentally, we believe that procedure to be responsible in large measure for the many deficient and defective dentures in the mouths of the young draftees.

Economic conditions incident to the long years of depression also played a part in neglect of mouth conditions.

It is the failure of the public and the reluctance of the medical profession to recognize and admit the relation of mouth health to bodily health that has allowed, not to say encouraged, a large amount of the dental unfitness for service that is now attracting such attention from the defensive forces of the Government.

We are now confronted with the dramatic revelation of a situation in which more than one-third of those found to be physically unfit for army service are unfit solely because of failure to meet the minimum dental recruiting regulation. It is a dramatic revelation in that it is so directly related to conditions and circumstances just now occupying the center of attention of the whole world, a situation not only dramatic in itself, but one that also may easily become tragic in its consequences to us as individuals and to the nation at large.

Dentistry has been so busily engaged in the repair and patching-up of defective dental organs that the profession has been inhibited in its effort and opportunity to render a greater service to humanity in applying its intelligence and skill in the prevention of that large class of ills, the effects of which it labors so strenuously to repair.

Whether or not our analysis of the fundamental reasons for an increase in masticatory deficiency is correct in no sense relieves the dental profession of responsibility for correcting the conditions, which are present in an alarming degree. The dental profession has long since recognized and accepted this responsibility, but thus far has been unable to meet the situation in a manner satisfactory to all and to the end desired. Lack of concerted action and diversity of opinion as to methods of procedure have stood in the way of any constructive plan of action.

The health of the Army and of the civilian population is a first consideration in any program of defense, and, to this end, it is imperative that proper use and conservation of the health services of the nation be planned so that dental service shall be available to all.

Consideration of the nation's dental needs and an understanding of the disastrous effect on the mouth health of the military as well as civil population if measures to conserve and properly utilize dental resources are not adopted has led to an effort on the part of the American Dental Association to formulate a definite plan of rehabilitation with the purpose of facilitating the work of the Selective Service System.

Recognizing the futility of incoordinated effort and recognizing the

probability of reflection on the dental profession from inaction, the President, Dr. Wilfred H. Robinson, called a special meeting of the Trustees of the American Dental Association for August 3, to give special attention and consideration to the formulation of a plan for rehabilitation that would relieve this serious interference with the work of the Selective Service System.

Accordingly, a special meeting of the Trustees was held at the Stevens Hotel, Chicago, Sunday, August 3, with every member present, and, with the members of the Committee on Dental Preparedness, the Committee on Economics, the Committee on Legislation and the National Health Program Committee, the Board proceeded to a discussion of the problems.

The National Health Program Committee, through its chairman, Dr. Harold W. Oppice, presented a complete program, formulated by the committee after careful consideration of the problem, for rehabilitation of draftees unavailable for military service because of dental deficiencies.

The President then appointed as a committee of the whole the four committees above mentioned, with instructions to consider the suggested plan and report back to the Board the result of the deliberations.

The plan of rehabilitation as it was finally adopted and as printed on another page in the present issue delegates to the dental profession a serious task, the accomplishment of which not only will relieve the Selective Service System of one of its most serious dilemmas, but also will go far toward removing a stigma that has unwittingly been brought on the dental profession.

This program will be presented to the proper government officials as an offer of the American Dental Association to aid in the important problem of rehabilitation during the time of the national emergency.

The purposes of this plan are (1) to afford the registrant participation in his own rehabilitation, (2) to select more suitable men and increase the number of inductions, (3) to improve national morale by decreasing the number of rejections, (4) to cultivate in the registrants the spirit of self-reliance, initiative and patriotism and (5) to effect rehabilitation through maintaining the normal relationship of the patient to his family physician and dentist.

The prosecution of the plan has been delegated to the National Health Program Committee whose efforts will be supplemented by the cooperative relationships of the committees noted and under this direc-

torship, we are confident that the plan will be prosecuted to the credit and prestige of the dental profession.

The current program for national defense has thus far brought to light many problems relating to public health and physical fitness, and those concerned in prosecuting the program fully recognize health as an essential element of preparedness. At the same time, the responsibility of the profession for the dental health of the community is just as pressing and probably more so when at a time a large percentage of the population is being drawn into military service.

"A STUDY OF THE DENTAL NEEDS OF ADULTS IN THE UNITED STATES"

THERE has been widespread discussion regarding the need for dental health programs throughout the country, with considerable planning to supply this need. Before an effective dental health program can be planned, however, it is essential that reliable facts regarding dental needs be available.

With this in mind, the Committee on Economics of the American Dental Association has undertaken a rather broad survey to ascertain certain aspects of dental need. An abstract of one phase of the survey is published in another section of the present issue and the full report of the survey in brochure form is available through the Committee on Economics.

It was the purpose of the survey to determine the average need for each specific type of dental correction among that section of the population that visit the dentist. It was a further purpose of the survey to determine the relative need for care among dental patients in different age and sex groups and in various income levels.

While the number of cases reported on in connection with the survey was not so large as might be desired, it is felt that the study has supplied at least a partial answer to several of the pressing questions regarding dental need. A groundwork has been laid for more intelligent planning of dental programs, and a beginning has been made in a field of research that needs to be greatly expanded.

BIBLIOGRAPHICAL

Dental Formulary

By HERMANN PRINZ, A.M., D.D.S., M.D., Sc.D. Emeritus Professor of Materia Medica and Therapeutics, The Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania. Cloth. 352 pages. Price $3.50. Philadelphia: Lea and Febiger, 1941.

THIS well-known formulary of items of dental interest maintains much of its old form. It is essentially a compendium of recipes and formulas, of the type which enjoyed greater popularity in the past. Thus, there are formulae for the making of guttapercha, dental cement, solder and gold plates of various types, methods of electroplating, oral preparations as mouth washes, tooth powder, etc. It covers a wide range of information, including a section on oral diseases with a short discussion of their etiology, diagnosis and treatment. The actual usefulness of a volume of this type in modern times is somewhat problematic. That it contains a fund of potentially useful information cannot be denied, but as present day practice is carried out, it seems that the volume will serve best in the reference library.

University of California. Hospital Formulary

Fabricord. 270 pages with index. Price $2. Los Angeles: University of California Press, 1941.

THIS small book differs from other hospital formularies in its completeness. The volume will easily fit into a coat pocket. For its size, it contains an amazing amount of information relative to the prescribing of drugs, their chemical properties, certain trade-marked preparations, the use of dietary procedures in certain illnesses and a brief description of clinical and laboratory tests, which the junior house officer will appreciate having in such an accessible form for ready reference. The book is printed in clear, but fine type on thin paper and is excellently set up. This volume may well serve as a guide for other hospitals writing similar treatises, this one having the advantages of completeness and compactness, which certain others lack.

Education for Family Life

The American Association of School Administrators, a department of the National Educational Association, Washington, D. C.

EDUCATION for Family Life, the latest yearbook of the American Association of School Administrators, published February 1941, evaluates the family in terms of the needs of the individual as well as the needs of society, thus giving concrete expression to the oft quoted phrase, "The family is the bedrock of society." It points out that serious attention should be given to the effect upon families of social and economic changes, race suicide and broken homes. It challenges both school and home to greater endeavor in helping husbands and wives, fathers and mothers, boys and girls as they strive to make the American home realize its fullest possibilities. This volume should be in the library of every parent and teacher who has the task of inducting children or youth into life. It contains a list of organizations with materials and services of use in education for family life, including the services of the American Dental Association.

The book sells for $2. Make checks payable to the American Association of School Administrators, 1201 Sixteenth Street, N. W., Washington, D. C.

The Sagebrush Dentist

WILL FRACKELTON, D.D.S., and H. G. SEELEY. Published by A. C. McClurg & Co., Chicago. Price $2.50.

To those whose youth dates back to the halcyon days of the wild west thriller, "The Sagebrush Dentist" will recall fond though perhaps painful memories. Something in its style reminds us of Diamond Dick and Buffalo Bill, whose exploits we faithfully followed behind the sheltering pages of a sixth grade geography.

Younger dentists, perhaps, may find Frackelton's memoirs less interesting because to them Cody, Calamity Jane and Custer are only names in history books, and Reno, Sioux and Cheyenne merely names of cities.

Many of the 246 pages contain exciting descriptions of exploits that will never again be lived. To cite one exciting incident from this interesting story: "The situation was desperate, and Stillwell and a companion slipped away . . . to bring relief from the nearest fort. It was a plains country and at dawn the only hiding place available was an old buffalo carcass. The pair crawled in and lay there, listening to the Indians as they galloped back and forth on their ponies. Suddenly a rattlesnake appeared, also intent on entering the carcass. . . ."

In "The Sagebrŭsh Dentist," we see, through the eyes of a dentist, the transition of the Western Plains from the Indian wars of the eighties to the dude ranches of today.

The American Illustrated Medical Dictionary

A complete dictionary of the terms used in medicine, surgery, dentistry, pharmacy, chemistry, nursing, veterinary science, biology, medical biography, etc. By W. A. NEWMAN DORLAND, A.M., M.D., F.A.C.S., Lieut.-Colonel, M.R.C., U. S. Army; Member of the Committee on Nomenclature and Classification of Diseases of the American Medical Association; Editor of the "American Pocket Medical Dictionary." With the Collaboration of E. C. L. MILLER, M.D., Medical College of Virginia. Nineteenth edition, revised and enlarged. 1647 pages with 914 illustrations; including 269 portraits. Flexible or stiff binding. Philadelphia and London: W. B. Saunders Company, 1941. Plain $7.00. Thumb-indexed, $7.50.

DORLAND's dictionary has become an indispensable reference work to every one in the medical world and in dentistry in particular. The new edition is thoroughly revised and contains many words both in medicine and in dentistry that have recently appeared in the nomenclature. It is particularly interesting and valuable to the dentist because it contains the new words used in dental literature and the latest pronunciation and spelling and accurate definitions and derivations of these new terms. It also has expanded a new feature of the book, the presentation of portraits and short biographies of many dental notables. A particularly valuable feature of the American Illustrated Medical Dictionary is the fact that the derivation of the terms is accurately presented and the pronunciation of every word indicated. When to capitalize a word and when not to is made plain, and a clear and concise definition of every word is given.

Applied Orthodontics

By JAMES D. MCCOY, M.S., D.D.S., F.A.C.D. Associate Clinical Professor of Surgery (Oral), School of Medicine, University of Southern California; formerly Professor of Orthodontics in the College of Dentistry, University of Southern California. Fifth edition. Cloth. 333 pages. Price $4.50. Lea and Febiger, Philadelphia. 1941.

THIS well-known textbook continues in much of its previous form. There has been a small amount of new material added, and several new illustrations are included. The volume continues as an eminently practical, concise text on the diagnosis and treatment of certain abnormalities of the occlusion. Its brevity and clear style makes it exceptionally useful as a textbook. The author continues to use gnathostatic photographs and models with good effect. There is no discussion of certain other technics of orthodontic diagnosis, as the cephalometric methods of appraisal. The use of the round arch wire with buccal tubes or the lingual fixed appliance appears to be most useful in the author's hands. This volume should continue the popularity of its predecessors.

BOOKS RECEIVED

Cottrell's Appointment Diary for 1941. Cottrell and Company, 15-17 Charlotte St., London, W. I., England. Indexed by months with each week's appointment spaces printed on adjacent pages. Price 3/6 net.

Your Mental Health

By B. LIBER, M.D., Dr. P.H. Cloth. 408 pages. Price $3. New York: Melior Books. 1940.

ASSOCIATION ACTIVITIES

Contents

PRESIDENT'S PAGE

The Rehabilitation of Inductees 1515

NATIONAL HEALTH PROGRAM COMMITTEE

Program for Rehabilitation of Registrants Rejected for Dental Defects Under the Selective Service Act 1518

The Status of Research Bill S. 194 1520

COMMITTEE ON DENTAL PREPAREDNESS

Military and Civil Dental Needs of the Nation 1521

Notice to Examining Dentists on Local Selective Service Boards 1523

COUNCIL ON DENTAL THERAPEUTICS

Nutrition and Dental Health with Special Emphasis on Periodontal Relationships. Dorothea F. Radusch, D.D.S., B.A., M.S. 1524

BUREAU OF PUBLIC RELATIONS

Children's Fund of Michigan 1533

A Comprehensive Dental Health Program
Harry Strusser, D.D.S. 1534

COMMITTEE ON LEGISLATION

Court Upholds Michigan Law 1537

DENTAL MUSEUM

Report of the Committee 1539

RESEARCH COMMISSION

A Second Edition of "Dental Caries" 1540

COMMITTEE ON ECONOMICS

A Study of the Dental Needs of Adults in the United States
R. M. Walls, D.D.S.; S. R. Lewis, A.B., J.D., and M. L. Dollar, A.B.. 1541

A. D. A. ANNUAL MEETING

Pan American Day at Houston 1549

Hotel Reservations 1550

Schedule of Rates 1551

A New Century of Dental Progress 1552

Huntsville Rodeo 1553

AMERICAN DENTAL ASSOCIATION MEMBERSHIP

Membership Percentage Chart 1555

NEWS ITEM

Third Medico-Dental Convention 1554

OBITUARIES

John A. Marshall 1556

Abraham Lincoln Greenfield 1557

William Hopkinson 1557

Deaths 1558

President's Page

INFORMATION ON THE REHABILITATION OF INDUCTEES

A LARGE percentage of the men who are rejected for military service under the Selective Service Act are disqualified because of dental deficiencies. Even in normal times, the wide prevalence of dental defects is a matter of concern to the dental profession; and in a time of unlimited national emergency, it becomes an even more serious problem because of its effect on the health of the manpower needed by the country.

For many years, the danger of accumulating dental defects has been known and pointed out by the American Dental Association and its constituent and component societies. Programs on dental health education, oral hygiene and preventive dentistry have been initiated and developed under the leadership of these organizations. Many of these health programs have been successful, and their success points to the ultimate solution of the problem.

But there have not been enough of these programs, and they have not been given all the support that they needed by those agencies having a definite responsibility for dental health. The result is that the country now faces a loss of manpower that could have been prevented by heeding the warnings of the profession and by taking advantage of the aid and experience which the profession offered for preventing and correcting dental defects through a reasonable, scientific, long-range program.

Because of this lack of cooperation, there is now the immediate problem of making manpower available through the correction of those dental defects which disqualify registrants from participation in full military service. An approach to this problem has been made in a plan for the "prehabilitation" of registrants. This plan attempts, by a program of dental health education, to have registrants secure necessary dental care at their own expense before they appear before local draft boards for physical examinations. It will be effective in proportion to the willingness and the ability of the registrant to pay for needed dental care.

It seems very likely that all necessary dental correction will not be assured without other effort. This fact demands that dental care be made available to registrants after they have been rejected for dental defects by their local draft or examining induction boards.

Such dental care can be utilized in a program of rehabilitation to qualify rejected registrants for military service.

Since a program of dental rehabilitation has many complex elements, the President of the American Dental Association decided to call a special meeting of the Board of Trustees to discuss the problems involved. This meeting was held in Chicago August 3, and to it were invited the Committee on Dental Preparedness, Committee on Legislation and National Health Program Committee, together with those individuals and agencies that had had contact with problems of dental rehabilitation under other auspices.

It is gratifying to report that every member of the Board of Trustees was present for the meeting and that many of those who attended left their vacations or their practices in midsummer to discuss this important problem. The entire day was devoted to the development of a rehabilitation program and to the preparation of facilities for carrying the program to an effective conclusion.

The program adopted unanimously by the Board of Trustees may be found elsewhere in this issue of THE JOURNAL. It should be pointed out that it falls into three sections.

The program of rehabilitation recognizes, first, that, most desirably, dental care would be made available through the facilities of states, communities and volunteer agencies. It cannot be expected, however, that a rehabilitation program employing only those resources would provide care on the scale necessary or desirable.

The plan of the American Dental Association, therefore, recommends, as the most effective program, one in which rejected registrants would be inducted into the armed forces under adjusted dental standards. The necessary dental care would then be provided by the dental personnel of the armed forces. Although some practical difficulties lie in the way of this program, it is to be emphasized that this second plan is recommended as probably the most effective by the American Dental Association.

Dental rehabilitation is, of course, only one part of a general program of physical rehabilitation. An official commission of the government has studied this problem and has issued a report in which it is recommended that federal funds be made available to the Federal Security Agency of the United States Government to pay for physical rehabilitation. When the legislation necessary to make this plan effective is being considered by the Congress, the third section of the American Dental Association's rehabilitation program will provide the specifications under which an effective dental program can be established. These specifications are based on principles approved by the House of Delegates of the American Dental

Association and on the tentative program recommended in the official report of the Commission on Physical Rehabilitation.

It is not possible, of course, to state definitely at this time which of these programs will be put into operation. That decision remains in the future. The American Dental Association, however, will devote all of its power and ability to securing a satisfactory program of dental rehabilitation under the program adopted at the special meeting of the Board of Trustees.

In order that all phases of this complex problem might be explored with maximum effectiveness and minimum delay, the Board of Trustees decided to authorize one committee of the American Dental Association to undertake the work connected with the development and establishment of a program for dental rehabilitation. The Board of Trustees, therefore, directed the National Health Program Committee, of which Harold W. Oppice, of Chicago, is chairman, to undertake this task.

This committee was instructed to immediately present the program of the American Dental Association to proper officials in Washington so that the views of the organized profession would be available in developing a working program of rehabilitation. The committee was also authorized to offer the use of the facilities of the American Dental Association in finding a solution for the problems involved.

Through this action, the American Dental Association approached the important problem of dental rehabilitation on a national scale, and officers of component and constituent societies are asked to bear this in mind when local problems of dental rehabilitation are under discussion. Every effort will be made to get information on new developments to all members promptly so that they can aid in this contribution to the national welfare.

In times of crisis in the past, dentists have rendered excellent service individually and through their dental organizations. Assuredly, every member of the American Dental Association will continue that record of service, and it can best be continued by supporting the efforts of organized dentistry to secure the adoption of an effective plan for dental rehabilitation. Only if this is done will the individual dentist and the organized profession be making the contribution of which they are capable in this time of our country's need.

Wilfred H. Robinson.

NATIONAL HEALTH PROGRAM COMMITTEE

DENTAL REHABILITATION PROGRAM

IN recognition of the contribution that an effective dental rehabilitation program would make to measures of national defense, the Board of Trustees of the American Dental Association met in special session at the call of the President, Wilfred H. Robinson, August 3, in Chicago. The dental rehabilitation program was formulated by a committee consisting of members of the Committee on Dental Preparedness, the Committee on Economics, the Committee on Legislation, the National Health Program Committee and the Bureau of Public Relations of the American Dental Association; members of the Dental Advisory Committee to the Selective Service System, members of the subcommittee on dentistry of the Health and Medical Committee and a representative of the Selective Service System.

This committee unanimously adopted a program for submission to the Board of Trustees. The Board unanimously approved the program and assigned the National Health Program Committee the task of presenting it to proper government officials and securing its adoption.

The dental rehabilitation program approved by the Board of Trustees recognizes that dental care for rehabilitating dentally disqualified draftees may be provided voluntarily by states, communities and volunteer agencies. As the most effective plan, the program adopted by the Board recommends the induction of dentally disqualified registrants into the armed forces on a provisional basis so that dental defects may be corrected by the dental personnel of the armed forces.

In the recent report of the Commission on Physical Rehabilitation, it was proposed that federal funds be appropriated to the Federal Security Agency to pay for the physical rehabilitation of draftees. The program adopted by the Board of Trustees outlines the specifications under which dental rehabilitation may be carried on most effectively in the event that such legislation is sought by the federal government.

The complete text of the aproved report follows:

PROGRAM FOR REHABILITATION OF REGISTRANTS REJECTED FOR DENTAL DEFECTS UNDER THE SELECTIVE SERVICE ACT

THE American Dental Association recognizes that the dental rehabilitation of registrants found dentally deficient under the Selective Service Act can be accomplished in a variety of ways.

The American Dental Association recognizes that a contribution to the national welfare can be made by the provision of funds for dental rehabilitation, under the initiative of states, communities and volunteer agencies.

The American Dental Association further recognizes that such a program would not have the most effective possible results in making manpower available for military service.

The American Dental Association, therefore, recommends, as the most effective program, one in which dentally deficient registrants are provisionally inducted into the armed forces and then provided with the needed service by the

dental personnel of the armed forces.

In the event that Congress considers legislation providing funds for a program of dental rehabilitation, the American Dental Association recommends that the following plan form the basis of such legislation:

1. Selective Service form No. 200 and War Department form No. 221, AGO, would be amended so that: (a) the examining dentist could state whether the dental defects, in his opinion, were remediable; (b) registrants whose defects were remediable could be placed in special classifications to indicate the correctability of the defects; (c) registrants thus classified could signify their willingness to undergo corrective dental procedures, could permit the release of information pertinent to their remediable defects and would indicate whether they would provide adequate treatment out of their own resources.

2. Selective Service regulations would be amended to permit the necessary examination, duplication and proper use of confidential records relating to the defects of the registrant.

3. The National Director of Selective Service would be asked to issue the following regulations to all local boards: The chairman of the local board shall write to all registrants in the special classifications advising them that dental defects are the primary cause of disqualification and that these are considered remediable in the opinion of the examining dentist. The chairman shall further advise such registrants to have the remediable dental defects corrected by their own dentist or, if the registrant is unable to bear this cost, to apply to the state or local dental rehabilitation committee. The chairman shall further advise such registrants of the time that the board has allowed for the correction of dental defects, at the expiration of which time the registrant must report to the board for reexamination and reclassification.

4. In all states and local areas, dental rehabilitation agencies should be established by the designated federal agency on the following basis:

The state dental rehabilitation committee shall be under the jurisdiction of the state agency designated to administer the rehabilitation program. It shall be composed of the ranking dental official in the state government (who will be the executive officer), representatives of proper state agencies, the organized dental profession . . . and such other agencies and groups as are deemed necessary. The majority of this committee shall be dentists nominated by the organized dental profession.

The local dental rehabilitation committee will be under the jurisdiction of the state dental rehabilitation committee. The ranking community dental official will be the executive head of this committee, which shall be composed of representatives of the state dental rehabilitation committee, the organized profession and such other local agencies and groups as are deemed necessary. The majority of this committee shall be dentists nominated by the organized dental profession.

The duties of the state and local dental rehabilitation committees will be to collaborate with professional groups, with state and local governmental agencies and with volunteer agencies in the development of state and local rehabilitation facilities.

5. The federal government will be asked to appropriate sufficient sums of money to pay for an effective rehabilitation program, the funds to be administered by a designated federal agency through official state agencies and state and local dental rehabilitation committees.

6. Federal funds are to be expended for dental care in a rehabilitation program under the following conditions:

(a) Any method of rendering dental care which is recognized and approved

by the local dental rehabilitation committee may be employed for rehabilitation.

(b) All standards of dental care rendered under this program must be in accord with those recognized and approved by the local dental rehabilitation committee.

(c) The standards for dental fees and salaries under this program shall be determined by the local dental rehabilitation committee and based upon the standards of living in the community. A basis for determining unit-operation fees may be found in the fee schedule of the Veterans Administration.

(d) Any method of compensation for dental care which is approved by the local dental rehabilitation committee may be employed in this program. This includes unit-operation, salary or capitation fee.

The committee on the whole passed a motion requesting that the Board of Trustees adopt this program as the official policy of the American Dental Association and that the Board of Trustees authorize its immediate presentation to proper officials as the official policy of the American Dental Association.

The foregoing measures for the rehabilitation of rejected registrants with remediable dental defects are proposed by the American Dental Association in recognition of the contribution such a program of dental rehabilitation would make to measures of national defense. Its proposals are based on principles established by the House of Delegates of the American Dental Association and are developed within the framework suggested in the report of the Commission on Physical Rehabilitation.

The American Dental Association will cooperate wholeheartedly in the development of this program and will take necessary measures to enlist the aid of its more than 50,000 members. Other resources and facilities of the American Dental Association will be freely available in this effort to aid national defense by the rehabilitation of dentally rejected registrants.

THE STATUS OF RESEARCH BILL S. 194

A HEARING on Dental Research Bill S. 194, was held on July 14 by a subcommittee of the Committee on Interstate and Foreign Commerce of the House of Representatives. The research bill has already been passed by the Senate and is now awaiting the action of the House of Representatives. If a favorable report is made by the subcommittee before which the hearing was held, it is expected that the bill will be reported favorably to the House in the next few months.

C. Willard Camalier, member of the National Health Program Committee, presented the following to testify for the bill on behalf of the American Dental Association: Daniel F. Lynch, secretary of the Research Commission; Sterling V. Mead, vice-chairman of the Committee on Legislation, and Harold Hillenbrand, secretary of the National Health Program Committee.

Others testifying on behalf of the bill were Warren F. Draper, M.D., acting surgeon general, United States Public Health Service; Marian M. Crane, M.D., Children's Bureau, United States Department of Labor; Capt. A. Knox, Dental Corps, United States Navy; W. J. Pelton, United States Public Health Service, and Randolph Bishop, executive secretary of the National Dental Hygiene Association, Washington, D. C.

Members of the subcommittee conducting the hearing for the Committee

on Interstate and Foreign Commerce were: Alfred L. Bulwinkle, chairman, North Carolina; Lyle H. Boren, Oklahoma; Rudolph G. Tenerowicz, Michigan; Oscar Youngdahl, Minnesota, and Clarence J. Brown, Ohio.

COMMITTEE ON DENTAL PREPAREDNESS

MILITARY AND CIVIL DENTAL NEEDS OF THE NATION

THE Selective and Service Training Act has been in operation sufficiently long to show its present and probable future effect upon the resources of the dental profession with respect to national dental health, while the call to active service of members of the Dental Reserve Corps of the Army, Navy and other armed forces has demonstrated the disturbing effect on the civilian population of the withdrawal of dentists from private practice. In view of this fact, the time seems propitious for the profession to review the present situation in an effort to determine the best approach to an adequate preparedness program for the nation and, at the same time, to assure, as far as possible, adequate dental facilities for the civilian population.

The administrators of the Selective Service System, after long and careful study of the situation in the dental profession, concluded that the resources of dentistry should be conserved as far as possible. In order to ensure the greatest economy of dental resources, it issued, under date of May 12, a memorandum to all state directors (1-99) which contained the following significant statement:

> Although the War Department reports that there are now sufficient officers in the Dental Corps Reserve to meet their current requirements . . . it is apparent that there is an over-all and increasing national shortage of dentists. Further, the supply is not distributed in accordance with the population, so that consequently there are present shortages in some local board areas, while, on the other hand, there are present surpluses in other local areas. However, any such surpluses may be substantially reduced and even wiped out entirely by reason of the requirements of the armed forces and the increased civilian requirements. . . . The local board has the problem of deciding, subject to appeal, whether or not an individual dentist is so necessary to a community that he should be deferred from training and service under the provisions of paragraph 350-353 of the Regulations. This problem should be approached with a clear appreciation of the over-all national shortage, and with the health needs of the community clearly in mind. In classifying, the local board should give full weight to the fact that the Dental Reserve Corps is at present of sufficient strength to fill current Army needs.

Prior to the issuance of this memorandum, it was brought to the attention of the Committee on Dental Preparedness, by its state military affairs committee, and so reported to the Congress by this committee, that approximately one hundred dentists had been inducted into the service as privates. Since the foregoing memorandum was issued by Selective Service, few dentists have been inducted.

To alleviate the situation with respect to the inducted dentists, the War Department paralleled the action of Selective Service by the issuance of the following directive dated May 5, under the signature of the adjutant general:

> Individuals who are qualified for appointment in the Dental Corps Reserve and who have been inducted under the provisions of the Selective and Service Training Act of 1940 should be encouraged to apply for appointment in order that they may serve in a professional capacity. Individuals accepted for appointment will be discharged and ordered to extended active duty for a period of twelve consecutive months.

While there may be some necessary delay in the issuance of commissions to the qualified dentists applying for commissions under the provisions of the foregoing directive, the

committee is reliably informed that every effort is being made to expedite each case so that commissions may be awarded as promptly as possible.

As a result of the call of dental reserve officers to active service and the induction of a limited number of dentists as privates, the public is faced with a loss of dental service due to reduction of dental personnel in certain areas of the United States which can ill afford such losses. It is, therefore, obvious that some dentists with reserve commissions are being called who could better serve the defense needs of their country by continuing in civilian practice. This presents a situation that requires careful thought and action. In preparing a solution to the question, it must be remembered that men who have commissions in the Dental Reserve Corps accepted them in order that they might be of service to their country in time of national emergency. It is doubtful, however, whether many gave due consideration to the civilian needs of their respective communities and to the loss to these communities in the event that the dentists were called to active service. Naturally, some of them are now in a dilemma and are undecided how to best serve their country. On the other hand, the War, Navy and other departments have had these men on their reserve lists for years and have seen to it that they received periodical instructions in military procedures, and, when the national emergency arose, they naturally turned to these resources for the most likely material available to meet emergency needs.

The Committee on Preparedness is of the opinion that this difficult situation should be met realistically. If a dentist is needed greatly in his home community, and this extreme need should be definitely determined by careful study irrespective of whether the dentist has a reserve commission or not, he should be deferred and another reservist ordered to active duty in his place. This course seems logical and equitable since the War and Navy departments have pointed out that their reserve corps quota is currently more than sufficient to meet the needs. If, later, the Dental Reserve Corps personnel becomes dangerously low, it is believed that an appeal for volunteers would bring an immediate response. The committee does not advocate the plan by which the reservists resign their commissions to serve in civilian capacities. The national emergency might become so great that eventually it would be necessary to again call them to active service.

After carefully reviewing all phases of the situation, the committee concluded that the coordination of the military groups and Selective Service is desirable in order to achieve the greatest good for all concerned. In an effort to bring about a better situation, the committee suggests the following procedures for consideration and action:

1. That Selective Service continue its efforts to prevent the induction of dentists in a non-professional capacity in order that the "over-all and increasing national shortage of dentists," be curtailed.

2. That Local Selective Service Boards maintain the normal or increased flow of dentists into the profession by continuing to defer predental and dental students, as recommended by General Hershey in his memorandum of May 12.

3. That the War Department continue to commission as promptly as possible all inducted and qualified dentists in accordance with the directive of the adjutant general of May 5.

4. That the War and Navy departments, through their corps areas or districts, or as they may otherwise determine, consider carefully the relation of population needs to dental facilities of each community from which a reserve officer is to be called, so that no community in the United States may be deprived of adequate dental personnel.

5. If a dental reserve officer is regarded as necessary to his community, but feels that he would prefer to serve under his commission, or that he would be of more value to his country in that capacity, every effort should be made by the dentist himself and the state military affairs committee to see that adequate dental personnel is made available to compensate for his loss to the community. The practice of the dentist should be safeguarded in a form similar to that outlined in Bulletin 13, issued by the Committee on Dental Preparedness.

6. That state military affairs committees

and local dental societies cooperate effectively with Army Corps Area dental surgeons and commandants of the Navy, in the study of each community within the area, to the end that a situation may be developed to meet the military and civilian needs of the nation. While it is realized that the solution of this problem is not strictly a responsibility of the Army or Navy, and no undue hardship on individuals is intended because of their already exacting duties, yet the Corps Area dental surgeons and commandants of the naval districts could make a distinct contribution to the civilian population needs by reporting to state military affairs committees any lack of civilian dental personnel surrounding their respective camps and districts. The names and addresses of these chairmen were sent to Corps Area dental surgeons and commandants of naval districts by the Committee on Dental Preparedness in Bulletins 4, October 16, 1940, and 7, November 27, 1940, respectively. However, because of changes in personnel of some committees, the committee is requesting its secretary in Chicago, Gerald D. Timmons, to forward a complete list of the state military affairs committees in the respective areas, in the belief that they will prove of value.

The committee urges all chairmen to contact the Corps Area surgeons and commandant on matters of importance and warns against bringing outside political pressure to bear, as was done in a recent case. The relationship existing between the central committee, the state military affairs committees, Corp Area surgeons, commandant, Washington Army and Navy Headquarters, and Selective Service, is excellent, and all these matters can be satisfactorily adjusted within the various agencies involved.

The Committee on Dental Preparedness welcomes any constructive comments on these suggestions.

Sincerely yours,

COMMITTEE ON DENTAL PREPAREDNESS,
C. WILLARD CAMALIER, *Chairman*.

NOTICE TO EXAMINING DENTISTS ON LOCAL SELECTIVE SERVICE BOARDS

THE Committee on Dental Preparedness has received the following communication, dated August 11, 1941, from C. Ramond Wells, lieutenant commander (DC), USNR, chief dental officer, Medical Division, Selective Service System, which is self-explanatory:

Thinking you may wish to transmit to members of the American Dental Association who are to serve as examining dentists on local boards information concerning the procedure they are to follow upon being notified of their appointment, we state the following:

After a dentist is notified that he has been appointed as examining dentist to a local board, he should report to the local board at once for instructions relating to duties, hours, when his services will be required, etc. At this time he will sign the acceptance of appointment, the oath of office and a waiver of compensation. It may be some time before he receives the official certificate of appointment from Washington.

The examining dentist should then procure Medical Circular No. 2, Dental, and familiarize himself with it so that he will know the dental requirements for registrants.

Thanking you for your cooperation,

COMMITTEE ON DENTAL PREPAREDNESS,
C. WILLARD CAMALIER, *Chairman*.

COUNCIL ON DENTAL THERAPEUTICS

NUTRITION AND DENTAL HEALTH, WITH SPECIAL EMPHASIS ON PERIODONTAL RELATIONSHIPS

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[This article is presented as one in the Council's series on pharmacology and therapeutics. On behalf of the profession, the Council expresses appreciation to the author for her contribution.—HAROLD L. HANSEN, *Secretary.*]

CRITICAL study of nutritional findings suggests the advisability as well as importance of diets for dental patients which will provide optimal nutrition as far as it is now understood by nutritionists. It is well-established that few patients, regardless of economic status, are on optimal diets, when judged by generally accepted dietary standards.[1, 2] The inadequacies of typical dietaries and the influence of slight, but multiple deficiencies over long periods have been clearly shown by research on laboratory animals as well.[3, 4, 5, 6]

Only infrequently are any of the essentials completely missing from the diet. Nor is it often that only one factor is deficient. Rather, several factors are involved simultaneously.[3, 7, 8, 9] Furthermore, deficiencies may be found in apparently healthy people, since lack of obvious signs of ill-health is not a criterion of good nutrition.

There is a good deal of accumulated evidence that diet affects the bone and soft tissues about the teeth, as well as caries susceptibility or immunity. Data are still unavailable as to the exact amounts of minerals, vitamins or other dietary factors necessary to protect dental tissues. Therefore, general nutritional principles must be followed, rather than emphasis upon single factors. The dentist can contribute much to the general health, including dental health, of his patients by emphasizing the need for ample amounts of milk, meat, eggs, high-colored vegetables, fruit, whole grain or enriched cereals and vitamin D, with greatly lessened quantities of sweets and refined cereals.

CALCIUM-PHOSPHORUS-VITAMIN D-PROTEIN

Numerous investigations demonstrate that marked rarefaction of bone with an increase in fat cells of the bone marrow can be produced by calcium deprivation,[10, 11, 12, 13] while there is further evidence that, on low-calcium diets, changes in the jaw bones are more extensive than changes in other bone.[14, 15] It has been shown that, in dogs, when diets are low in calcium and relatively high in phosphorus, with no cod liver oil, the original jaw bone structure is entirely replaced by a deficient uncalcified tissue and the resorptive process is markedly increased. Even with adequate calcium and phosphorus, but without vitamin D, progressive bone atrophy (osteoporosis) of the jaw occurred, the supporting bone being replaced by fat marrow.[16, 17a] On an adequate mineral diet, active reparative processes took place in the jaw bone.[16, 17] Labelled (radioactive) phosphorus was deposited in bones, following the feeding of single doses.[18] In general, maxillary bone contained greater concentrations of the marked phosphorus than mandibular bone, while greater phosphorus uptake was observed in bones of

rachitic rats than in their normal litter mates.[19] Bone changes following extraction of maxillary molars in rats were greater in those kept on low-mineral diets than in those on adequate diets.[20]

A significant negative association between the periodontal condition and the calcium, phosphorus, protein, animal protein and milk intake was found in a statistical study of a dietary survey of 135 dental patients. Estimation of the calcium content of the diet best predicted the periodontal condition when foodstuffs provided the source of calcium.[21] Hilming[22] found the most severe cases of periodontal disease in diabetic patients who were forbidden milk, the food which is the only rich calcium source in the dietary. Due consideration must also be given to the possible influence of essential factors provided by the milk along with its calcium value.

The cited data are of especial interest because surveys indicate that calcium and phosphorus intake are commonly too low to satisfy the conventional standards of 0.68 gm. of calcium and 1.32 gm. of phosphorus; while there is evidence that the standards probably should be higher for optimal nutrition. The animal research suggests, too, the importance of vitamin D in maintenance of periodontal tissue health.[17, 23, 24] However, adults do not consistently or frequently use vitamin D preparations, and there is as yet no way of measuring quantitatively the vitamin D that they obtain from sunlight.

Utilization of calcium is dependent on other factors also. One of these may be the protein intake. Ingestion of 92 and of 97 per cent of commonly accepted standards of calcium per 70 kilograms was not sufficient to prevent losses in young woman subjects if protein was fed at 75 per cent of the requirement.[25] Furthermore, inadequate protein consumption may be more prevalent than is generally suspected and may be responsible for a variety of symptoms of ill-health.[26, 27]

VITAMIN A

The effect of vitamin intake upon periodontal tissues is a popular subject. Mellanby[27] has published evidence that deficiency of vitamins A and D during the first six to eight months of the life of a dog, the period of active development, makes the animal more susceptible to periodontal disease even though the diet is later adequate. On the other hand, resistance of the tissues was high if the diet during the developmental period was good, even though there were subsequently long periods of deficient diet. The pathologic effects of vitamin A deficiency upon the epithelial structures have been clearly demonstrated,[28] in animal and human subjects. Yet when monkeys were fed a vitamin A deficient (partial deficiency) diet, there was very little, if any, change clinically or histopathologically in the periodontal tissues.[23, 24] Clinical patients were found to have a low intake of vitamin A, but it was not significant statistically when correlated with the periodontal condition.[21]

VITAMIN C: RESEARCH AS APPLIED TO PERIODONTAL TISSUES

Acute scurvy exhibits classic symptoms in the oral mucous membrane, gingival tissue and bone. While this observation has stimulated a line of research, it has also been responsible for the overemphasis on the rôle of vitamin C in gingivitis or periodontal disease.

Howe[28] described looseness and elongation of teeth, alveolar process disintegration and various periodontal tissue changes in guinea-pigs on a scorbutic diet. All these conditions were improved by adding orange juice. It must be remembered that this experimental work was done before much was known about vitamin D; that the guinea-pig is unusually susceptible to vitamin C deficiency, and that orange juice supplies factors other than vitamin C. More recently, Boyle, Bessey and Wolbach[29] fed guinea-

pigs a diet free of vitamin C supplemented by different levels of ascorbic acid, and reproduced acute scurvy, with congestion of the gingivae, marked rarefaction of alveolar bone and widening of the periodontal membrane, accompanied by loosening and wandering of teeth, but without typical pocket formation. A completely vitamin C deficient diet produced extensive necrosis of the gingivae of monkeys.[23, 24]

At present, a good deal of research on human subjects is being reported. The broad conclusion of Hanke[30] that "the addition of a pint of orange juice and the juice of one lemon to a diet that is nearly adequate in all other respects supplies something that leads to a disappearance of most of the gingivitis" and "that gingivitis redevelops in most cases when the citrus fruit intake is reduced to three ounces a day for one year" does not seem to be in accord with his published data which show that, of 267 cases, "only 120 improved on the pint of orange juice, but gingivitis redeveloped or became more severe during the recheck period."

In contrast, Herlitz[31] found no connection between the presence or absence of gingivitis and the ascorbic acid content of blood serum in a series of forty-four children without gingivitis and fifty-seven with severe gingivitis, free of any other noticeable symptoms of illness. He stated that this affection must be referred to other etiologic factors. Normal healthy children who got raw fruit (an orange or an apple) every day in addition to what appeared to be otherwise normal food had an ascorbic acid content of 0.71 ± 0.073 mg. per cent. Those who seldom had raw fruit had values of 0.24 ± 0.025 mg. per hundred cubic centimeters. (From 0.0 to 0.4 mg. is accepted as indicating a very poor state of vitamin C nutrition, from 0.4 to 0.8 mg., moderately good and from 0.8 to 1.2 mg., very good; while values above 1.2 mg. per hundred cubic centimeters of blood plasma indicate full saturation or excellent vitamin C nutrition.[32, 33]

In the case of adults, there is evidence of a possible vitamin C deficiency in periodontal disease in the presence of special medical conditions and of the need of only small amounts of dietary vitamin C for tissue protection. Low vitamin C intake was found associated with gastro-intestinal complaints, deficient diets as prescribed in colitis or allergic states, dislike of ordinary foods and poor economic conditions.[2, 34] Fifteen patients in a feeding test[34] showed clinical improvement in two weeks when given ascorbic acid (200 mg. a day for a five-day week). No clinical improvement was noted in less than two weeks, even though normal blood levels were reached in some cases after one week. When ascorbic acid additions were discontinued, all but three cases (colitis) could be satisfactorily maintained, both as to normal blood values (1 mg. per hundred cubic centimeters) and as to clinical improvement, by adding 2 ounces of orange juice to the diet daily. (Two ounces supplies 25-30 mg. ascorbic acid.)

Other studies on blood plasma ascorbic acid concentrations as related to the incidence of bleeding gums or gingivitis indicated little or no correlation.[2, 35, 36] In a series of 100 cases, thirty-eight were found to have a blood plasma ascorbic acid concentration below 0.4 mg. per hundred cubic centimeters (in scurvy, the blood level falls below 0.4 mg. per hundred cubic centimeters[37]), while three were between 0.10 and 0.20 mg. per hundred cubic centimeters, and yet no cases of clinical scurvy were recognized.[2] No significant correlation was found between the estimated intake of vitamin C and the periodontal condition by a dietary survey of 135 dental patients.[21] One hundred seven took orange or grapefruit almost daily, yet gingivitis was present in most instances.

VITAMIN C: DAILY REQUIREMENTS AND STANDARDS

The daily requirement of an adult for the prevention of scurvy has been variously estimated as from 15 to 25 mg. of ascorbic acid,[38, 39] which is the physiologically indispensable minimum. The severe symptoms of scurvy, "soreness and stiffness of joints, swelling and bleeding of gums with loosening of teeth, and hemorrhages under the skin on various parts of the body," are seldom seen in this country.[38] Experimental studies have shown other cellular changes with varying levels of vitamin C deficiency. This indicates the need for a standard representing the amount that would result in a state of health which could not be bettered by further additions of vitamin C.

Many investigators believe that optimal nutrition, the state of health which cannot be bettered, is best secured by giving all the vitamin the body can hold. This state is commonly called saturation, and is measured by the spill-over of vitamin C into the urine that occurs after repeated large doses of the vitamin are given.[38]

Even though it is not universally accepted that it is desirable to maintain the tissues in a constant state of saturation, it is obvious that the daily requirement under ordinary circumstances cannot be greater than the minimum amount which will maintain such a state of saturation. The saturation requirements in one study ranged from 70 to more than 100 mg. of ascorbic acid daily, or from about 1 to 1.6 mg. per kilogram (2.2 pounds) of body weight daily.[38] The standard daily allowance of vitamin C is 50 to 100 mg., depending on the authority. (Fifty milligrams is the amount in one-half cup of orange juice.) This amount is not difficult to obtain. As Sybil Smith[38] comments:

For those accustomed to taking a glass of orange juice or other fruit juice, grapefruit or fresh berries in season as a matter of course at breakfast, there is little danger that the total daily intake of vitamin C from all sources will furnish less than 75-100 mg. daily.

In recent studies by the Bureau of Home Economics,[40] the middle 50 per cent of the diets of white families provided 50-100 mg. of ascorbic acid a day. (These averages represent the value of the uncooked food. They are higher, therefore, than the value of food actually eaten.)

A point of interest is the consistently higher ascorbic acid content of the diets at all cost levels in the Pacific than in the North Atlantic region for the city families, the only group for which data are reported for both these regions. These differences are brought out even more strikingly in the detailed report on the diets of families of employed wage earners and clerical workers in cities.[39]

If, as many believe, bleeding of the gums or gingivitis is the first symptom of vitamin C deficiency, one might look for a significant difference in incidence of gingivitis or periodontitis between these two regons. Or, in spite of the recognized rise in vitamin C consumption[40, 41] throughout the United States, has a decrease in incidence of the above-mentioned conditions followed?

From the present data on vitamin C and those on food consumption habits of the people of the United States, coupled with the high incidence of investing tissue disease, it would appear that a complete lack or even an exceedingly low intake of vitamin C is not found in the average periodontia patient. It is conceivable that certain "limited" diets might be so lacking in vitamin C that additions of therapeutic amounts would be advisable in the treatment of periodontal lesions appearing in such patients. The relatively small amount of vitamin C necessary to prevent symptoms of scurvy, or even to maintain blood ascorbic acid levels at 1 mg. per hundred

cubic centimeters, and the increased national consumption of vitamin C foods, as well as the fact that dogs may develop periodontal disease in spite of (1) an ability to synthesize their own vitamin C or (2) their exceedingly low requirement,[14, 27, 42] suggest that some other factor or factors are commonly of greater importance.

VITAMIN B COMPLEX

The term vitamin B complex is applied to a group of water-soluble factors, the best known being thiamin (B_1), nicotinic acid and riboflavin. There is little direct evidence as to the rôle of these substances in dental conditions. Research on monkeys "fed on diets deficient in certain vitamins resulted in the development of necrosis of the periodontal tissues and oral mucosa of varying extent, qualitatively similar in the B_2 complex deficiencies with variations in the flavin and nicotinic factors, in the C deficiency and in the D deficiency, and probably greatest in extent in the B_2 deficient groups.[23, 24] B_1, or thiamin, deficiency was not included in the experiments.

Administration of adequate amounts of nicotinic acid, or compounds acting similarly, to persons with acute or relapsing pellagra will cause fading of the fiery red lesions of the mucous membranes and striking improvement within from twenty-four to forty-eight hours in the gingivitis and Vincent's infection associated with it.[8, 9] Spies[8] states that Vincent's organisms grow in myriads wherever the mucous membranes are affected by pellagra. King[43] reports successful treatment of severe ulceration in the mouth associated with the presence of Vincent's organisms in four cases by oral doses of nicotinic acid with no other local treatment. Others[44] have failed to see a beneficial effect from large doses of nicotinic acid in acute Vincent's infection.

Unquestionably, there is a distinct difference in the clinical symptoms of variously described lesions all termed "Vincent's infection." With such lack of agreement as to what constitutes the disease entity, it is not strange that there is confusion as to the response to treatment.

Nevertheless, the symptoms and treatment of stomatitis found in pellagra and allied deficiency disease[7, 8, 9, 45] are highly suggestive of the possible influence of B complex vitamins; particularly, since the average American diet is so likely to be deficient in these related vitamins. The lack of these factors is due largely to the proportionately greater percentage of the daily calories now being obtained from refined cereal and sugar foods. Too, no single serving of a common food will supply the majority of the daily needs of this group of vitamins or any of its members as is the case with the amount of vitamin C found in an average serving of citrus fruit.

For these reasons, enrichment of common foods is advocated. When naturally occurring substances which have been removed in refining are added in amounts sufficient to approximate the original concentration, the process is termed "restoration." When the amounts added are greater than those naturally occurring in the foodstuff, it is termed "fortification." The use of cereal foods so enriched is basically sound and desirable.

VITAMIN RESEARCH INTERPRETATION

Now that information as to the chemical nature of the vitamins is rapidly advancing, more exact study of their significance in human nutrition and the effects of different levels of intake will be possible. In the past, specific interpretation of results of feeding experiments has been handicapped when foods were used as vitamin sources. The bulk of the literature pertaining to the topic falls in this class. Howe's[28] early scorbutic research has already been cited. Another example frequently quoted in vitamin C

literature[46] is the case in which a patient suffering from gingivitis and having abnormally low vitamin C excretion was given large doses of orange, lemon and tomato juice daily, whereupon the gingivitis cleared up. Since greatly increased daily excretion of vitamin C accompanied the oral changes, it was concluded that the results were due to vitamin C. Such an assumption cannot be made, because the large amounts of fruit juice also supplied rich sources of the vitamin B complex factors, affected the acid-base status of the system, exerted a local cleansing action and may have supplied as yet unidentified substances. Only when pure chemical vitamins are fed can results be safely interpreted as being due to the vitamin intake.

LOCAL ACTION OF FOOD

There is a widespread clinical opinion that certain local actions of diet are important to dental health, yet factual data on the subject are few. One of the earliest studies [47] was on the effects of sticky, balanced and detergent diets, with or without the use of the toothbrush. When the toothbrush was not used, the appearance of the teeth was cleaner after "sticky" (soft) and balanced diets than on the supposedly "detergent" diets. When brushes were used, the appearance in each case was similar. The soft, detergent and balanced diets varied in the number of organisms found in the order listed, with the lowest number in the balanced. The authors concluded that artificial cleansing with the toothbrush is many times more effective in reducing the absolute numbers of mouth organisms than is the cleansing accomplished through a diet of "detergent" elements.

On the assumption that a detergent diet not only may effect some degree of cleaning of the teeth, but also has a definite stimulating effect on the gingival tissue, periodontal membrane and alveolar bone, the effects of detergent and non-detergent diets were studied by use of capillary microscopy.[48] It was stated that gingival tissues of human adults, when a diet was hard and detergent, were well hornified, with normal gingival capillaries; whereas persons using a soft and non-detergent diet showed marked dilation of these vessels (if oral hygiene was not practiced with sufficient care.) There was no evidence presented that the two diets were nutritionally the same, differing only in consistency, while there is reason to believe that the "soft" diets, such as were described as containing a preponderance of refined foods, are more apt to furnish fewer essential food factors. Thus, the tissue differences may have been due to conditions other than the consistency of the diet.

In animal experimentation, Mellanby[27] stated that a continuously soft and sticky diet containing abundant carbohydrate, so long as the diet is of proper nutritional standard, can be eaten by dogs for at least eight years without development of periodontal disease, local or general. She suggests that the diet during the period of development is, because of the liability of the tissues to infection in later life, of greater significance than the subsequent diet.

More recent research by others[49] with dogs on diets identical chemically, but different physically, shows that although gingival changes due to consistency of diet are variable, soft diets tend to cause more pathologic changes. Histologic findings confirmed the clinical observations. Examination of the sections revealed inflamed and desquamated epithelium and typical pyorrhea pockets in the gingivae of animals on mash diet.

Doubt as to the superior value of diets for human beings requiring a great deal of chewing is cast when one checks on reports of surveys of the dental status of primitive races. Such description generally states that the mouths are unclean and gingival disease is present. For ex-

ample, Waugh[50] said of the Eskimos who led the nomadic life of their ancestors and used a native diet unchanged by contact with civilization that even though they were essentially caries-free, "there was gingival disturbance in practically every individual of 10-12 years or over, owing to a abundance of flint-like deposit of calculus that encroached upon the supporting structures until in old age this was the greatest factor in the loss of teeth and leading to nearly total destruction of the supporting tissues."

The stimulating effect of vigorous function may have produced heavy jaw bone development in the Eskimo, as to both the body of the jaw and the alveolar process, but, even so, hard foods and vigorous function did not protect the investing tissues from disease. At the other extreme, a human tooth which has been entirely functionless for a long time was shown by Kronfeld[51] to have a periodontal membrane poor in structure, while the trabeculae of the supporting bone were almost entirely missing. Those tissues of a functioning tooth in the same mouth appeared quite normal. It should be pointed out that similar contrasting histologic pictures have been shown in experimental animals on inadequate and adequate diets,[16] when function was not a variable.

In addition, there is a vast difference between total dysfunction and some degree of function. To date, the degree of function which will permit normal tissue maintenance has not been measured. Clinical experience would indicate that the physiologic response of the tissue is a more pertinent factor than actual pounds pressure. From the research reviewed, especially that on mineral metabolism, it would seem reasonable to assume that the tissue response is due at least in part to the nutritive status. As previously stated, shifting of teeth in experimental animals occurred to a greater extent in those kept on inadequate mineral diets.[20] Likewise, it seems logical that some degree of function is desirable for development and maintenance of supporting tissues. Until further data are presented, moderation is probably advisable.

CONCLUSION

Dietary factors can influence the health and disease of the dental tissues, but the present status of knowledge is such that, for the most part, answers cannot be given as to specific dental application. Nutritional factors of importance to general health have a bearing on dental health also. Nutritionists recognize that deficiencies in dietary essentials occur commonly. They may be due to inadequate intake, increased need, diminished absorption, increased destruction or diminished utilization of the essential substance or substances. The primary cause has been found to be a diet that is quantitatively and qualitatively adequate. Though this may often be due to financial inability to purchase food, too many times it is due to faulty dietary habits, food likes and dislikes, chronic alcoholism or too long adherence to arbitrary diets prescribed for therapeutic purposes.

With such a large percentage of diets in marked need of improvement, and since tradition, habit or "natural selection" are not safe guides to optimal nor even adequate nutrition, dentists should advise the adjustment of food habits and diets to conform with the principles of good nutrition. For an adequate diet, a simple guide for the daily menu should be followed:

Meat: One serving of meat, fish or fowl daily; or at least five times a week.

Milk: One pint to one quart daily.

Eggs: One or two daily, or at least five a week.

Butter: One or two tablespoons daily.

Vegetables and fruits: Five servings daily: One serving of citrus fruit or

tomato. One serving of potato. One serving of green or yellow vegetable. Two other servings of fruit or vegetable.

Cereal foods (foods composed predominantly of grain products): Four to six servings daily, with at least half of whole-grain or enriched cereal.

Desserts: Once daily, twice only when it will not displace protective foods.

Refined cereal, not enriched, and sugar foods, including soft drinks, desserts and candy, should be limited because they are likely to usurp the place of foods supplying dietary essentials as well as having other undesirable effects.

To indicate the need for improvement of the patient's diet, it is recommended that dietary histories and analyses be made whenever possible. Simple directions for this have been previously outlined in the literature.[17, 52]

With the exception of vitamin D, which does not occur to any appreciable extent in common foods, it is best to obtain minerals and vitamins from natural food sources rather than from pharmaceutic preparations. There is considerable evidence that the body may use vitamins from foods better than in chemical form, either because of known factors supplied at the same time which are necessary for efficient utilization or because of as yet unrecognized factors. Pure chemical forms of dietary essentials are best used for research or experimental purposes, in the occasional clinical case in which very high doses must be given, when the food cannot be tolerated or when it is known that oral administration is ineffective.

By presenting sound, broad facts, the dentist can assist in the important problem of educating people to choose or accept a diet that not only meets the energy requiremenst, but also provides a liberal allowance of all nutrients.

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BUREAU OF PUBLIC RELATIONS

CHILDREN'S FUND OF MICHIGAN

THE Children's Fund of Michigan, which was created in 1929 by the late Senator James Couzens, of Detroit, "to promote the health, welfare, happiness and development of the children, of the State of Michigan primarily, and elsewhere in the world," has reached the halfway mark of its existence. On May 1, it began the thirteenth year of its activities. One requirement of the trust is that principal as well as income shall be completely used for children at the end of twenty-five years from the date of gift.

The spirit of the fund lies chiefly in finding new ways of promoting human betterment by aiding and improving the minds and bodies of growing children. In the words of Hugo A. Freud, president of the fund, "The Children's Fund, dedicated to the children of Michigan and to youth elsewhere in the world, has in this era and in the thirteen years to come a function to perform—a duty that these sorrowful times impose. It must help to find a way to prepare the children of today to present a united front to solve the new problems certain to be reality from now on!"

From its beginning, Mr. Couzens and his board of trustees felt that the fund should concern itself with exploratory projects in the field of public health and mental hygiene. If these projects proved their worth, the fund would withdraw its support in favor of local or community management. One of its major undertakings has been to prove, by demonstration, the usefulness of county health departments. By the close of last year, the fund was aiding twenty health departments covering forty-two counties. Aid was conditioned upon the selection of well-trained non-political workers; and upon the acceptance of a definite understanding that additional local funds would be appropriated from time to time if the work proved satisfactory and that support of the fund would be gradually and entirely withdrawn.

Total expenditures from the trust funds last year for all purposes amounted to $703,167.77. They were allocated to the fields of child health, mental health, medical research, dependency and recreation. The sum of $390,541.18 was expended by all units of the Child Health Division, including approximately $96,000 expended on the dental program.

The most important event in the dental division was the return of the Detroit dental program to the city board of health July 1, 1940. The fund took over this service to school children several years ago when the city was in financial straits. With the return of responsibility to the city, the fund's appropriation was reduced. It will be reduced again the forthcoming year and eliminated in 1942. In the meantime, the city has been generous in increasing its own appropriations and the service is now increasing.

The rest of the dental work is divided into three parts: an all-year county service; a special summer program, and a program at Children's Hospital of Michigan in Detroit.

The regular program was given in forty-eight counties and two urban areas. Twenty-eight dentists and forty-four dental assistants were employed, the services of the latter being paid for out of local monies. This staff, working closely with school officials, nurses, private dentists and relief authorities, inspect the teeth of school children and make cor-

rections in the mouths of indigent children. They also carry on a public educational program stressing the need for dental health. Appreciation of this service is evidenced by the fact that $21,000 was contributed locally to make it more effective.

The summer dental program was conducted for twelve weeks in nineteen counties and districts. Young dentists just out of school are employed on a strictly correctional program in areas where the need for this extra service is apparent.

In both of these departments, the fund is experiencing difficulty in getting and keeping full staffs. It is evident that the work during this forthcoming summer will be curtailed through a shortage of men.

The program at the Children's Hospital of Michigan under the direction of O. W. White has been continued. At the hospital, free orthodontic service is available for indigent children, and bedside dentistry is supplied to sick children in the wards.

In addition to maintaining a comprehensive dental program, the Child Health Division last year financed county and district health department demonstration projects at a cost of $152,436.22. The health education unit expended almost $12,000 and the eye correction program cost approximately $13,000.

As might well be supposed, the fund has been particularly active in the care of crippled children, last year expending approximately $89,000 for that purpose alone. Grants were made to four independent child health agencies totaling $23,500. Child guidance received grants of slightly over $100,000, medical research about $57,750 and child dependency $40,000, while contributions to independent recreational agencies amounted to $35,000.

The trustees and directors of the Couzen's fund are to be congratulated upon their achievements during the past twelve years in the field of child health. Certainly, they have proved their statement that "projects conceived for the well-being of the growing child can heighten a public conscience, can raise the health level of the state and can plan an organization which may serve as a model for other communities."

A COMPREHENSIVE DENTAL HEALTH PROGRAM

By HARRY STRUSSER, D.D.S., New York, N. Y.

PUBLIC health officials have often stated that when a disease becomes widespread, it constitutes a community health program. It has been known for a long time that 90-95 per cent of school children are suffering from dental disease, but events of recent months have brought us face to face with a more serious problem, due either to neglect or oversight.

Let us examine some of the available records and from them derive a *modus operandi* to avoid the errors of the past.

1. The dental conditions of our Selective Service registrants and applicants for enlistment throughout the country have shocked us. The physical dental requirements of the Selective Service age group are definitely low, yet, in the New York area, 11.37 per cent of the total number of men examined up to January 31, 1941, have been found ineligible, because of dental deficiencies. It is the highest percentage of all physical requirement deficiency groups and if considered only with the total number re-

jected, the percentage is 23, i.e., every fourth man rejected is rejected for a dental deficiency, Class 1B and 4F. Similar or worse conditions are reported in different parts of the country.

2. If the foregoing is the condition of the cream of the population, certainly the men in the defense program are no better fit dentally, and certainly it must be agreed that serious dental handicaps may affect health and cause loss of time in industry and the concomitant disruptions of a well-regulated production plant where every man and every hour counts, and especially where every man has his particular job to do.

TABLE 1.—WORK REQUIRED FOR 24,000,000 CHILDREN

Year	Children	Hours	Hours
First	12,500,000	×3	37,500,000
Second	12,500,000	×1½	18,750,000
	6,250,000	×3	18,750,000
	18,750,000		37,500,000
Third	18,750,000	×1½	28,125,000
	3,125,000	×3	9,375,000
	21,875,000		37,500,000
Fourth	21,857,000	×1½	32,812,500
	1,562,500	×3	4,687,500
	23,437,500		37,500,000
Fifth	23,437,500	×1½	35,156,250
	562,500	×3	1,587,500
	24,000,000		36,743,750

3. Dental conditions as shown by studies of groups of white collar workers show similar effects of neglect.

4. Studies of several groups of adolescents and adults on relief showed that 66⅔ per cent needed either one or two dentures to restore masticating efficiency. It must be remembered that, because of the peculiarities of the service, only those who had a 60 per cent deficiency were eligible for restorative service (dentures).

5. The population as a whole is dentally deficient to such a degree as to warrant consideration of the condition as a public health problem.

6. Dental disease is progressive. Cumulative effects of the disease and its concomitants have serious systemic effects on the aging population.

7. Dental caries is controllable and not communicable or contagious. While nearly 100 per cent of the population have dental disease, we must use measures to control loss of teeth, so essential not only to carry out the functions of daily life — the mechanical function (chewing)—but also to meet esthetic as well as speech requirements.

8. Oral health is essential to general health.

What can be done to control or prevent this scourge, and where should we apply the remedy to assure the most beneficial results at the least cost to the community? These avenues should be considered:

TABLE 2.—DEALING WITH A POPULATION ESTIMATED ON A 5 PER CENT CROSS SECTION

Under 5 years	10,597,891*
Balance	4,097,891
5–9	10,725,873
10–13	9,373,315
Total school population	24,197,079
14–24	26,325,633
25–44	39,743,302
45–64	25,947,055

*Those under 1 and 2 years of age approximately 6,500,000.

1. Research. This is being considered by Congress.

2. Education: dental health education programs integrated with the general health education programs for the child, adolescent, adult, expectant mother and the professions, medical, dental and nursing.

3. Dental health service for the group between the ages of 2 and 14.

According to the available figures of the 1940 census, approximately 24,000,000 children are in this group. About 2,000,000 come into the group annually and a similar number leave it.

Because of the preventive aspects of the program and because of the peculiarities of dental disease, the amount of time necessary to care for the cumulative defects is greater than the amount of time necessary to care for the increments of disease and for maintenance of oral health. The program must therefore be set up on a long range basis and yet have the desired results. There is no reason to establish an extensive program for the entire group to care for the cumulative defects and then reduce it to suit the needs of the increments. It is more desirable to have a continued program which will become more effective as it develops, taking into consideration the educational and research program progress.

Consider these 24,000,000 children: It would require a 37,500,000 hour program over a period of years to reach the maximum efficiency for this group and continue the program as shown in Table 1.

This group can be successfully cared for in each community through the school health program, which may use available facilities, private practice or clinical services in accordance with the conditions and economic needs of the community. Each community may set up a service to suit its particular needs. To further the program, the community may be subsidized (by some satisfactory arrangement on per capita or matched fund basis) by state and federal funds for either the installation of the program or its maintenance. Projects of similar character have been successful in the past in many communities. The control may be local and the state and federal authorities acting in an advisory, consultative or supervisory capacity.

Very often, we hear the remark "We haven't the personnel to do the job." This frame of mind is the result of applying the remedy at the wrong end. We have never concentrated on the job from the preventive and control point of view.

Let us consider the availability of the professional personnel: It would require 25,000 dentists working on a basis of 1,500 hours per annum to accomplish this task. That does not mean regimentation or socialization. The dental program of the community may include education for all and service only for the indigent or dentally indigent. However, it would take 25,000 dentists that amount of time to accomplish this task whether it were paid for by individual families or by communities, for its indigents. Of course, the program would use other personnel for administration, supervision and follow-up.

It has been reported that there are about 70,000 dentists in the United States. As stated above, if we employ 25,000 for this essential service, we have 45,000 available for the other age groups, which number approximately 90,000,000 members, if we eliminate age groups below 2 and above 65; or a ratio or 1 to 2,000. However, if we are to accept reports that no more than 20 per cent of the population go to the dentist in any one year, we have available a ratio of one dentist to 400 persons.

Eventually, the program would be entirely preventive and the growth of the profession would be promoted to the extent of providing personnel on a 100 per cent basis, or a ratio of one dentist to 1,000 persons—the same ratio as in military services in peacetime.

175 Fifth Ave.

COMMITTEE ON LEGISLATION

COURT UPHOLDS MICHIGAN LAW

IN a recent decision, the Circuit Court for the County of Wayne, in Detroit, Mich., upheld the validity of the referendum conducted in Michigan last fall, as well as the constitutionality of the 1939 amendments to the dental law. As is generally known, the opponents of the amendment enacted two years ago were able to obtain the required number of signatures of voters to force the state to permit the voters to vote upon the question of whether the amendments should be retained on the statute books of the state. This question was submitted to the voters at the time of the general election in November 1940.

The public vote on the question resulted in a majority of about 220,000 in favor of the retention of the law. Soon after this favorable outcome of the referendum, the same group of advertising dentists who opposed the law filed a petition asking the court to grant an injunction prohibiting the enforcement of the law against them, on the grounds that the referendum was illegally conducted and that several sections of the law violated the constitution. The case was argued on June 12 and 13 and the court's decision was rendered late in July. It appears to leave little room for further debate about the validity of the law.

The court first considered the plaintiff's claim that the act was not submitted to the electors by the method prescribed by the state constitution and that therefore the referendum was not valid. According to the plaintiffs, the constitution requires the inclusion in every ballot of the complete text of every law submitted to a referendum. In sections of the state where voting machines had been used, it was impossible to print the full text of the act and the machines had merely contained the question "Shall Act 122 of the Public Acts of 1939 regulating the practice of dentistry be adopted? (Yes) (No)," or words of similar import, although a full copy of the act was posted in each election place. Where paper ballots were used, the act was printed in full on the ballot.

The judge disposed of this claim in the following terms:

> It may well be questioned whether the provision of the constitution means what plaintiff claims it means. While it is true that the provision requires that "proposed amendments shall . . . be printed in full on a single ballot," it speaks of other matters to be submitted as "special questions." Does the requirement that "special questions to be submitted" shall be "printed in full" mean that when the question is the adoption or rejection of an act passed by the legislature, the whole act must be printed on the ballot, or is the constitutional requirement satisfied by printing in full the question "Shall Act Number 122 of the Public Acts of 1939 to regulate the practice of dentistry be adopted?" In my opinion, all that is required is the printing in full of the question, not the printing of the entire act.
>
> But be that as it may, there is a very practical reason which removes all of the force from plaintiffs' contentions. The grand total of the voting machine votes on the question was 161,884, of which 88,471 were for the adoption of the act and 73,413 against. If the entire machine vote were counted as against adoption and added to the paper ballot vote against adoption, or even to the entire vote against adoption, there would still have remained a large majority in favor of the adoption of the act.
>
> It is my conclusion that the act was properly submitted to a referendum of the voters and that even granting the invalidity

of the machine vote, its entire elimination would not change the result in favor of adoption.

The judge then took up in order the plaintiffs' charges that certain of the sections of the act were unconstitutional. In the first of these, the plaintiffs alleged that it was unconstitutional for the act to state that the "Governor . . . shall fill any vacancies (on the dental board) . . . from a list of three licensed dentists recommended to him by the Michigan State Dental Society." On this question, the court stated that the word "shall" could not be construed as limiting the choice of the Governor because this would be unconstitutional, adding

> . . . but unless there are other provisions of the law which contravene constitutional restrictions, the act should not for this reason alone be held unconstitutional. While ordinarily the word "shall" when used in a statute is mandatory and merely directory, it is a familiar rule that the legislature is to be presumed to have intended its enactment to be constitutional and, as said in 59 C. J. 1086, "Shall must also be construed as permissive when the statute can thereby be upheld, if a contrary construction would render it unconstitutional."
>
> As so construed, the appointive power of the Governor will be unrestricted, but appointments may be made from a list of three licensed dentists recommended to him by the Michigan State Dental Society.

The court disposed of the plaintiffs' objection to the citizenship requirement for all applicants for licenses with the statement that none of the plaintiffs were aliens and therefore they are not prejudiced by this provision.

The court upheld the provisions regulating practice by specialists and requiring all persons desiring to specialize to obtain a license, saying in part,

> It certainly is for the benefit of the general public and will be conducive to the prevention of deception to require that one who holds himself out as a specialist in some branch of dentistry shall have the approval of the governing board as being qualified to do the specialized work that he represents himself to be capable of doing. For instance, there is no good reason why one who is merely a tooth filler or a tooth extractor should hold himself out as an orthodontist, until he has become sufficiently proficient in that branch of the art to pass a qualifying examination.

The plaintiffs also alleged that the provision prohibiting a dentist from owning offices where he does not work were unconstitutional. The court answered this by stating that the protection of the public from ignorance, deception and fraud requires that the personal relationship between dentist and patient be retained and that the knowledge which a given dentist possesses should not be separated from control over the patient:

> The operation of branch offices owned by a licensed dentist, but conducted by hired employees (even though they be licensed) is to separate knowledge from the power of control and may therefore be prohibited.

Finally, the court upheld the restrictions which the law places upon advertising by stating that this question has been raised before in other states and that the overwhelming weight of authority recognizes the right of the legislature to prohibit unethical advertising practices. The court quoted at length from the famous Supreme Court case of Semler *v.* Oregon in which the power of the legislature to regulate advertising was clearly recognized.

The judge then summed up his whole opinion in the following words:

> It is my conclusion upon the whole case that the entire act, with the exception of the method of appointing members of the board (which may be disregarded because that method may be so construed as not to affect the validity of the law), is a salutary measure properly adopted both by the legislature and the people, for the promotion and protection of the public health, safety and general welfare and well within the police power of the state.

REPORT OF THE COMMITTEE ON DENTAL MUSEUM AND DENTAL REGISTRY

CIRCULATING COMMITTEE OF CONSULTANTS

IN connection with the biopsy service offered by the Registry of Dental and Oral Pathology, we have recently formed a circulating committee of consultants to which the more difficult and interesting cases will be sent for an opinion. All cases to be circulated will be reported as usual by the registry when received. This report will be followed by the consensus of the consultants at a later date. This program has had success in some of the other registries maintained at the Army Medical Museum, so far as it serves as a means for contributors to obtain the opinion of outstanding dental pathologists and for the consultants to study and review cases from all over the country.

The following men have been asked, and have agreed, to serve as consultants on this committee:

Kurt H. Thoma, Harvard University.

Balint Orban, Chicago College of Dental Surgery.

Lester R. Cahn, Columbia University.

Hamilton B. G. Robinson, Washington University.

The committee is now functioning and, in a short time, the first group of cases will be sent in for study and opinion. The decision as to which cases will be sent in for an opinion will, in all instances, be made by the Registry Office.

EXHIBITS RECEIVED BY MUSEUM

In the past two months, the museum has received an excellent exhibit on tumors and diseases of the oral region and gunshot and shrapnel wounds of the face from Bertram S. Rothwell, Cleveland, Ohio.

The exhibit consists, in part, of photographs in black and white showing gunshot and shrapnel wounds of the maxilla and mandible taken by Dr. Rothwell during the World War while assigned to Lakeside Base Hospital No. 4. The remaining material on tumors and diseases of the oral region is in color, being enlargements of 16 mm. movie film, retouched with water colors.

The entire exhibit has been mounted and is now on display in the Dental Section of the Army Medical Museum.

EXHIBITS OF REGISTRY MATERIAL AT SOCIETY MEETINGS

An exhibit on "The Activities of the Registry of Dental and Oral Pathology" of the American Dental Association, including the loan sets, atlas and state board material, was shown at the Pacific Coast Dental Conference, held at Portland, Oregon, July 7 to 11, 1941.

STATE BOARD MATERIAL

In the July issue of THE JOURNAL, a full explanation of this new program of providing examination material for the individual state boards was made. As some examining boards have been using this type of examination for some time, we have received the results of some of their examinations.

It is fair to say that those who have had occasion to use this type of examination are duly impressed with its simplicity and general adaptability. Those who are pioneering in this activity are enthusiastic. The Iowa State Board has reported to this office the results of its examination held last month and in general the results were very satisfactory.

It is earnestly suggested that those state boards interested in the details of this program write to the Registry Office, Army Medical Museum, Washington, D. C., for further details.

GENERAL

The activities of the registry are increasing daily. The biopsy service is be-

ing used by a constantly growing number, this indicating a definite trend toward an understanding of the value of knowledge of the underlying pathologic reaction of disease in formulating a rational treatment. This has been the chief aim of the registry and it is indeed gratifying to see such interest. We still feel, however, that many practicing dentists and oral surgeons are not entirely familiar with the service provided in this connection. If material, either biopsy or surgical, is sent in a suitable container, in 10 per cent formalin, a histologic report will be sent to the contributor.

This service is not intended to be competitive with that of local pathologists, but should be used through the local pathologist, when available, and directly when such service is not available.

During the present emergency, when civilian dentists are serving in the Army, many interesting and unusual cases are being seen daily. Many of these men have been familiar with the registry program and are using the biopsy service. Others are, for the first time, seeing the program function and will shortly, we hope, become contributors. In order that these men may profit most by the valuable experience available in the Army, they must thoroughly understand the conditions that are constantly being seen. It is in this connection that we urge use of the biopsy service.

JOSEPH L. BERNIER, D.C.,
Secretary and Pathologist to the Registry.

RESEARCH COMMISSION

SECOND EDITION OF "DENTAL CARIES"

A SECOND edition of "Dental Caries," now in press, will be ready for distribution early in September. The first edition, issued two years ago, presented summaries of findings and conclusions on the causes and control of caries by 195 authors or groups of authors in twenty-five countries, and contained 189 pages. The second edition will present not only revisions of many of the summaries in the first edition, the rest remaining unchanged, but also summaries by forty-two additional authors or groups of authors in twelve countries, and will contain 280 pages. These volumes present the realities in accumulated knowledge bearing on the causes and control of caries; afford opportunity for close study of the situation by every practitioner who wishes to ascertain the strength or weakness of current theories or procedures, and indicate need for further research in many relationships. This volume has been compiled by the Advisory Committee on Research in Dental Caries for the Research Commission of the American Dental Association to promote understanding, clinical observation, and research in this field. Copies, bound in cloth, may be obtained at the headquarters of the American Dental Association, 212 East Superior St., Chicago, Ill. First edition (1939), $1. Second edition (1941), $2.

COMMITTEE ON ECONOMICS

A STUDY OF THE DENTAL NEEDS OF ADULTS IN THE UNITED STATES

By R. M. WALLS,* D.D.S.; S. R. LEWIS,† A.B., J.D. and M. L. DOLLAR,‡ A.B.

THE dentist who has practiced his profession for a number of years has gathered from his experience a fund of valuable information regarding dental conditions among his clientele. He has observed relationships between dental needs and the age of the patients. He has noted differences in the dental needs of the sexes. If his clientele comes from a wide range of economic levels, he has noted differences in need as related to income level. Undoubtedly, he has observed an association between the regularity of a patient's visits to the dentist and the extent of his dental need. He has gained a general knowledge of these and other factors in dental needs, but he probably has never attempted to make a systematic analysis of his cases for the purpose of putting his observations into exact terms. Even had he done so, the value of his findings would have been limited, since it would be impossible for any one dentist to examine a representative sample of any large segment of the population.

Should the dentist seek information exceeding that of his general knowledge regarding the relationship of social and economic conditions as to the extent of dental need, he would find that there is a great lack of data on the subject. Few studies have been made to determine in an exact way what these relationships are. Of the studies that have been made, few have been on a scale large enough to assure conclusive results. Most of the studies that might be considered statistically reliable have been confined to select groups and do not give a representative picture of the needs of the population in general.¶ The reason for this lack of information is probably largely the fact that the primary concern of practicing dentists and of those engaged in dental research is, as it should be, with the technics of cure and correction of specific dental conditions.

The dental profession has an important rôle to play in modern society. While the first concern of the individual dentist is with technics of cure and correction as related to individual cases, the dental profession as an organized body has interests and responsibilities that go beyond the science of the profession. It has a definite social obligation, the promotion of a national program for dental health. This obligation was never greater than at the present time, since the need for dental health has never been more urgent than during the present national defense emergency. The dental profession stands ready to meet, to the best of its ability, this increased responsibility.

To plan an effective dental health program, it is necessary to have assembled reliable facts regarding dental needs. As has been pointed out, the information gleaned from the experience of the individual dentist, while valuable, is not exact enough in its statement nor broad enough in its scope to meet the need. Consequently, the Committee on Economics of the American Dental Association undertook this study of dental conditions, designed to determine the dental needs of the various sections of the population and to measure the effects of such factors as economic status, age and sex on the extent of dental need.

This study has been accomplished through the cooperation of more than 1,600 members of the American Dental Association, and thanks are due the members of the National Dental Association for their cooperation in this undertaking. Through this cooperative effort, it is possible to present, under con-

*Chairman of the Committee on Economics.
†Secretary of the Committee on Legislation.
‡Secretary of the Committee on Economics.
¶This statement relates to studies of dental needs of adults, several comprehensive studies of the dental needs of the younger age groups having been made.

trolled conditions, a composite picture of the individual findings, not of one individual dentist, but of more than 1,600 dentists.

Briefly, it is the purpose of this study to determine the average dental needs of adults 15 years of age and over; to investigate the relative dental needs of persons on different economic levels; to measure the effects on dental needs of regularity in visiting the dentist, and to determine the average cost of dental care for various age, sex and economic groups.

METHOD

In order to determine the dental needs of the adult population (15 years and over) in the United States, 55,000 questionnaires were sent out to 11,000 dentists, who were carefully selected in an effort to reach a representative sample of the general population. The dentists were given definite instructions regarding the selection of the patients on whom to report in order to avoid biases that would have developed if each dentist had made his own selection of patients. In all, 1,600 replies were received.

To insure the representativeness of the sample, a carefully designed procedure was followed in selecting the dentists who were asked to cooperate with the study. The schedules were distributed in each of the nine major geographic areas in proportion to the population within the area. Within each area, the schedules were distributed among communities of various sizes, again in proportion to the distribution of the population. Adjustment was made in the distribution of the sample among communities to account for the rural population served by the various types of communities. The dentists from each community included in the study who were called upon to participate in the gathering of the data were chosen by a careful plan of alphabetic selection.

An analysis of the schedules returned showed the distribution to be highly satisfactory. The distribution of the sample as to geographic area and size of community shows only minor deviations from the distribution of the general population.

A further check on the reliability of the sample was possible through a comparison of the age and sex distribution of the sample with those of the general population. (Fig. 1.) The age distribution of both the male and the female dental patients included in the sample follows very closely the age distribution of the general population. However, there were certain expected deviations that add rather than detract from the representativeness of the sample. The percentage of patients in the younger age groups was greater and the percentage in the older age group correspondingly smaller than is found to be the case in the total population. Further, the sex ratio of the sample shows that there are approximately eighty male patients for every hundred female patients visiting the dentist; whereas, in the total population, males are slightly in excess of females. Experience corroborates these findings.

There are certain limitations of the study to which attention is called. Since it was expedient to base the study on the needs of patients who visited the dentist during the period of the study, it follows that the sample is representative of those persons who visit the dentist. There are, of course, persons who never visit the dentist. Further, the percentage of patients of negro and other racial groups reported on was so negligible that the study has been limited to the white race. It is suggested that caution should be observed in applying the findings of the study to any specific local situation, since the sample on which the study is based represents a cross-section of the entire United States.

AVERAGE DENTAL NEEDS OF ADULTS 15 YEARS OF AGE AND OVER WHO VISIT THE DENTIST

Average dental needs have been analyzed in this study in three ways. First, average dental needs by types of need have been determined for each sex group according to five year age intervals. Second, average dental needs by type of need have been determined for each sex according to five year age intervals for four different income levels. Third, average dental needs by type of need have been determined for each sex group by five year intervals according to the length of time elapsing since the last visit to a dentist. However, in this issue of THE JOURNAL, only the first general analysis will be given.

In the discussion that follows, reference

TABLE 1.—DENTAL NEEDS OF 3383 MALES AND 4158 FEMALES 15 YEARS OF AGE AND OVER, INCLUDED IN A SAMPLE TAKEN OVER THE ENTIRE UNITED STATES, BY AGE

Sex Age	Total Cases	Average Need per Case							Percentage of Cases Needing:												
		(All Types) Fillings				Crowns	Extractions	Impactions	Fixed Bridges				Removable Bridges			Partial Dentures	Full Dentures		Prophylaxis	Root Canal Therapy	Pyorrhea	Vincent's Infection
		Total	One Surface	Two Surface	Three Surface				Total	One Bridge	Two Bridges	Three Bridges	Total	One Bridge	Two Bridges		Upper	Lower				
Total Males	3383	4.3	2.6	1.5	.2	.1	2.6	.1	20.7	12.9	6.0	1.8	7.6	4.9	2.7	15.7	14.9	10.2	65.4	3.6	13.6	1.9
15–19 years	313	7.0	4.4	2.2	.4	.1	.9	.1	18.1	10.5	7.0	.6	2.0	1.0	1.0	4.5	1.6	.6	77.0	5.4	2.9	1.3
20–24 years	450	6.5	3.9	2.1	.4	.1	1.1	.2	22.5	14.7	4.9	2.9	6.9	4.7	2.2	7.6	1.8	.7	80.2	4.4	7.3	3.1
25–29 years	433	5.7	3.3	2.0	.3	.1	2.4	.2	22.7	13.2	6.7	2.8	7.9	5.8	2.1	11.3	3.0	2.1	78.3	4.2	11.3	3.7
30–34 years	407	5.4	3.1	2.0	.3	.1	1.8	.1	25.3	15.5	7.6	2.2	9.8	5.4	4.4	16.2	5.4	1.2	75.4	3.9	14.5	1.2
35–39 years	380	3.7	2.1	1.4	.2	.1	2.5	.1	24.8	17.1	5.3	2.4	10.6	6.1	4.5	17.4	15.3	10.0	64.7	3.4	21.3	2.1
40–44 years	349	3.6	2.0	1.2	.2	.2	3.1	.1	22.9	13.7	7.2	2.0	9.7	6.3	3.4	21.8	18.3	14.3	57.9	2.3	20.9	2.0
45–49 years	321	2.7	1.4	.9	.2	.2	4.7	.1	17.5	8.4	7.5	1.6	8.7	6.5	2.2	23.7	25.5	17.4	55.8	3.1	15.6	.9
50–54 years	223	2.1	1.0	.8	.2	.2	4.1	.1	14.8	9.9	4.5	.4	7.1	4.9	2.2	20.2	36.3	25.6	52.0	1.8	22.4	1.4
55–59 years	170	1.8	1.0	.7	.1	.2	4.6	.1	14.7	8.2	5.3	1.2	5.3	2.4	2.9	22.9	40.6	27.1	47.6	2.9	10.0	.6
60–64 years	94	1.1	.6	.4	.1	.1	4.0	.1	7.5	7.5	—	—	9.6	8.5	1.1	17.0	40.4	37.2	35.1	2.1	13.8	—
65 and over	105	1.6	1.0	.5	.1	.1	3.4	.1	10.5	7.6	2.9	—	4.8	3.8	1.0	22.9	38.1	30.5	36.2	3.8	7.6	—
Total Females	4158	4.4	2.6	1.5	.3	.1	1.9	.1	19.9	12.3	6.0	1.6	7.6	5.5	2.1	16.3	12.9	8.1	69.2	3.1	11.7	1.8
15–19 years	414	6.5	4.1	2.1	.3	.1	.7	.1	13.8	8.0	5.6	.2	3.4	2.2	1.2	3.6	1.0	.5	72.7	4.3	3.6	1.2
20–24 years	593	6.5	4.0	2.2	.3	.1	1.1	.2	22.4	19.1	.9	2.4	7.1	5.1	2.0	10.1	1.8	.7	74.5	4.9	6.6	3.2
25–29 years	587	5.4	3.3	1.8	.3	.1	1.2	.2	23.5	14.7	6.1	2.7	6.8	5.4	1.4	11.2	3.9	2.4	77.5	2.4	11.7	3.6
30–34 years	557	4.4	2.6	1.6	.2	.1	1.8	.1	26.8	16.0	9.0	1.8	8.1	5.4	2.7	12.6	6.3	4.3	73.6	2.7	13.5	1.3
35–39 years	473	4.0	2.3	1.5	.2	.1	2.0	.1	26.2	16.5	7.6	2.1	11.0	9.5	1.5	23.2	10.1	4.2	67.6	3.8	16.7	1.1
40–44 years	407	3.2	1.7	1.3	.2	.1	2.4	.1	18.1	13.5	3.4	1.2	10.6	7.1	3.5	21.1	20.1	12.5	61.4	3.9	13.8	1.0
45–49 years	313	2.8	1.5	1.2	.1	.1	3.0	.1	14.7	8.3	5.4	1.0	9.6	6.4	3.2	26.8	26.2	19.2	83.4	2.2	15.3	1.6
50–54 years	254	2.3	1.3	.9	.1	.1	2.8	.1	13.0	6.3	5.1	1.6	7.5	4.7	2.8	22.0	33.1	23.2	50.8	1.6	15.3	.4
55–59 years	160	1.9	.9	.8	.2	.1	3.0	.1	13.7	8.7	3.1	1.9	7.5	4.4	3.1	26.9	35.0	22.5	53.1	2.5	13.7	.6
60–64 years	108	1.1	.7	.3	.1	.1	3.1	.1	4.6	1.8	1.9	.9	4.6	4.6	—	29.6	45.4	30.6	42.6	—	12.0	.9
65 and over	85	1.1	.7	.3	.1	.1	2.8	.1	4.7	3.5	1.2	—	4.7	4.7	—	24.7	42.4	25.9	48.2	1.2	10.6	1.2

is made throughout to average dental needs of large groups. Attention is called to the significance of the term "average need." The average needs shown for a group do not represent the actual needs of any particular individual, but rather represent the average for the entire group. They might be called the dental needs of a composite man representing the group.

GENERAL ANALYSIS

Average dental needs have been determined for all cases, "broken down" according to age and sex groups. Since the number of cases falling in each group in this gross type of analysis is relatively large, the findings are correspondingly more reliable, owing to the fact that, as explained above, the larger the number of cases, the more likely the cancellation of sampling discrepancies.

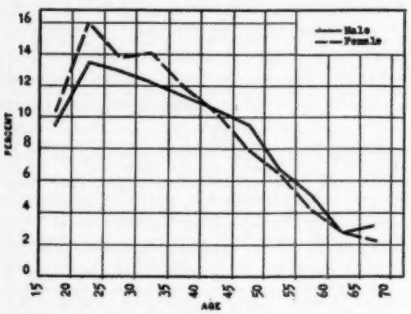


Fig. 1.—Age distribution of sample of 3,383 male dental patients 15 years of age and over compared with age distribution of sample of 4,158 female patients 15 years of age and over.

Table 1, on specific needs, gives a "breakdown" of all the more common dental needs by type of need. Under each type of dental correction is given the average need for persons of a given age and sex group. Attention is called to the fact that, under certain needs that represent a single unit, that is to say items of which an individual can have neither more nor less than one, e.g. full upper or lower denture, the table gives the percentage of persons in each age and sex group having that need rather than the average need per person. The logic of this presentation will be evident. The percentages can readily be converted into averages simply by moving the decimal two digits to the left.

Cases Having No Dental Need Other Than Prophylaxis.—It is found from the analysis that only 3.2 per cent of all male patients needed no dental care other than prophylaxis. Interestingly enough, the percentage of females having no dental need other than prophylaxis is exactly the same as the percentage of males.

Average Need for Fillings (Fig. 2).—The analysis reveals the average need for fillings to be almost perfectly correlated with age. It is found that the need for fillings is greatest for the age group 15-19 years. The average need for males at this age is approximately 6.8 fillings and for females 6.5 fillings. The need for fillings decreases by approximately 0.6 fillings with each five year increase in age. At age 65-

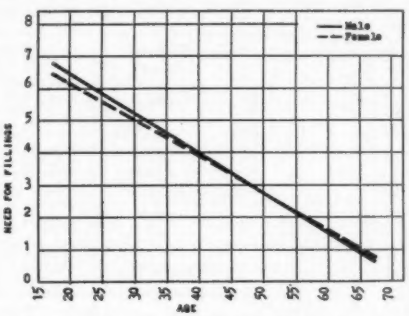


Fig. 2.—Average need for fillings for persons 15 years of age and over; by sex.

70, the need for fillings is only 0.6 fillings for males and 0.7 for females. The average need for all persons over 15 years of age is 4.3 fillings for males and 4.4 for females.

The decrease in the need for fillings is by no means an indication of a decreasing rate of deterioration. On the contrary, it is indicative of the accumulative effects of deterioration; that is to say, with advancing years, the number of extracted teeth increased. As the number of natural teeth decreases, the possible need for fillings decreases correspondingly. Examination of the need for extractions and for full dentures demonstrates the point very clearly, for it shows that, with increasing years, there is a cumulative loss of natural teeth that cor-

responds closely with the decrease in the need for fillings.

A comparison of the average need for fillings in males and females shows a striking similarity between the sexes. The two parallel each other so nearly that the difference could hardly be called significant were it not for the fact that similar differences for other types of need give support to the validity of the difference. In the younger age groups, the females show slightly less need for fillings, but, with increasing age, the

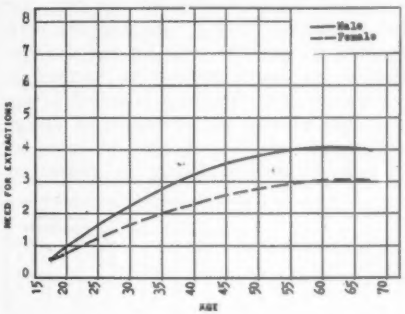


Fig. 3.—Average need for extractions for persons 15 years of age and over; by sex.

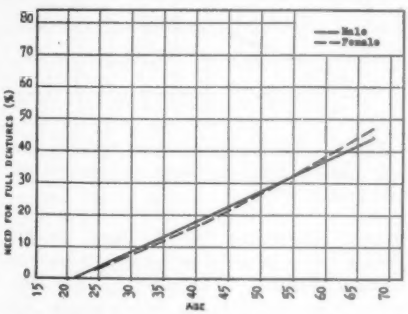


Fig. 4.—Percentage of those needing full dentures among persons 15 years of age and over; by sex. (Upper.)

difference grows smaller, and, in the highest age groups, actually reverses, the female need being somewhat greater than the male need. The explanation of this relationship probably is that because of better care, the females in the younger age groups have need for fewer fillings. Further, because of better care of the teeth, more natural teeth are retained by females than by males in the upper age brackets and, in consequence, there is a greater need for fillings. Additional evidence is given in later sections of this investigation in support of this explanation.

One, Two and Three Surface Fillings.—Of all fillings needed by males of all age groups, 59.0 per cent are one surface; 35.0 per cent, two surface, and 6.0 per cent, three surface. The distribution among the females of all age groups is almost exactly the same as for the males: 59.8 per cent, one surface; 35.1 per cent, two surface, and 5.1 per cent, three surface fillings.

TABLE 2.—PERCENTAGE DISTRIBUTION OF NUMBER OF FILLINGS NEEDED RELATED TO NUMBER OF EXTRACTIONS NEEDED FOR 2332 MALES IN THE AGE GROUP 15-44 YEARS OF AGE

Number of Fillings Needed	Total	Number of Extractions Needed				
		0 Ext.	1	2	3	4 & over
Total	100.0	54.6	18.9	8.7	4.7	13.1
0 fillings	19.0	8.5	3.3	1.1	.4	5.7
1 fillings	8.5	6.7	.9	.4	.3	.2
2 fillings	11.0	6.9	1.9	.8	.4	1.0
3 fillings	8.2	4.9	1.5	.8	.3	.7
4 fillings	8.0	5.0	1.2	.8	.4	.6
5 fillings	6.7	3.9	1.5	.4	.2	.7
6 fillings	6.6	3.4	1.7	.5	.4	.6
7 fillings	5.3	3.0	1.3	.3	.2	.5
8 fillings	4.6	2.8	.9	.3	.3	.3
9 fillings	3.9	1.6	1.0	.5	.3	.5
10 fillings	2.9	1.3	.5	.6	.2	.3
11 fillings	3.3	1.5	.8	.5	.3	.2
12 fillings	2.7	1.0	.5	.7	.2	.3
13 fillings	2.1	1.0	.6	.1	.1	.3
14 fillings	1.5	.7	.2	.3	.1	.2
15 & over	5.7	2.4	1.1	.6	.6	1.0

There appears to be a gradual increase in the percentage of two and three surface fillings needed with increasing age up to about 60 years. For some reason, the percentage of one surface fillings increases considerably for patients over 60 years of age. The male and female groups show similar characteristics in this respect.

Extractions (Fig. 3).—Next to the need for fillings, the need for extractions is the most common. As has been pointed out, there exists a close relationship between

the need for fillings and the need for extractions.

It is found that the need for extractions increases with age. This is the reverse of the relationship observed between the need for fillings and age. However, the need for extractions does not rise in a straight line as the need for fillings falls in a straight line. Rather, the need for extractions, starting at a need for approximately 0.6 extractions for both males and females for the age group 15-19 years of age, rises rapidly at first and then gradually levels out. Beyond age 55, the number of extractions needed levels out at about 4.0 extractions per person for males and 3.0 extractions for females. Beyond age 60, the average need for extractions begins to decrease slightly.

It will be noted that there is rather a striking difference in the need for extractions between males and females. While both sexes start with approximately the same need at the age of 15 years, the need of the male group increases much more rapidly than does the need of the female, until, at the age of 40, the male group needs on the average approximately one more extraction than does the female group.

Here, even more markedly than in the case of fillings, there is evidence of a better condition of the teeth among females than among males, probably resulting from better care. There would appear to be some evidence that contradicts the layman's belief that women suffer a great increase in rate of dental deterioration as a result of pregnancy. If this were true, it would be expected that there would be a more rapid rise in the need for extractions between the ages of 15 and 45 years for females than for males. Actually, the converse is true. Analysis of the need for fillings in the same light leads to the same negative conclusions. While the particular data given here are not conclusive evidence, they are sufficient to arouse strong suspicion that there is little, if any, connection between pregnancy and dental need.

Full Dentures—Upper (Fig. 4).—As would be expected, the average need for full dentures is closely related to the need for extractions. The need for full dentures rises in an almost straight line increase in relation to age. Attention is called to the fact that whereas the discussion of fillings and extractions is presented in terms of average number of fillings or extractions needed, the analysis of the need for full dentures is in terms of percentage of patients needing dentures. The need for full dentures is so low for the two youngest age groups that it disappears altogether in the process of straightening the curve mathematically. However, from the age of 25 years, the number of patients needing full dentures increases approximately with each increase of one year in age. At the age of 50 years, approximately 30 per cent of all dental patients need full upper dentures.

The comparison of need for full upper dentures between males and females reveals a surprising similarity. The female group shows slightly less need in the lower age group, but, in the upper age brackets, the

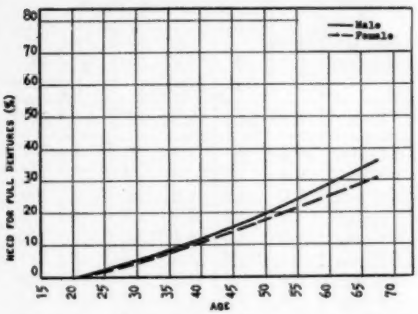


Fig. 5.—Percentage of those needing full dentures among persons 15 years of age and over; by sex. (Lower.)

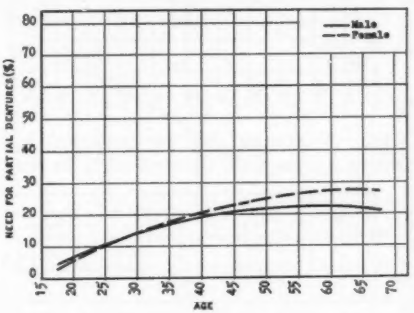


Fig. 6.—Percentage of those needing partial dentures among persons 15 years of age and over; by sex.

female need for dentures slightly exceeds the male need. However, the differences are so slight as to be statistically insignificant.

Full Dentures—Lower (Fig. 5).—Analysis shows the need for lower dentures to follow almost exactly the pattern followed by upper dentures, but on a lower level. With the need for upper and lower dentures starting at approximately the same level between the age of 20 and 25 years, the need for upper dentures rises at a sharper angle than the need for lower. At age 65-70 years, approximately 8 per cent more males and 16 per cent more females need upper than need lower dentures. At the age of 45 years, approximately 15 per cent of all patients, both male and female, need full lower dentures. At the age of 65 years, about 34 per cent of male patients as compared with 30 per cent of female patients need lower dentures.

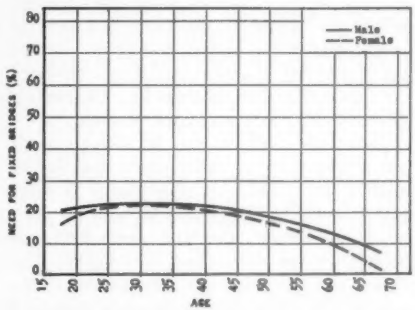


Fig. 7.—Percentage of those needing fixed bridges among persons 15 years of age and over; by sex.

Partial Dentures (Fig. 6).—The need for partial dentures starts, as would be expected, at an earlier age than does the need for full dentures. While the percentage of cases needing partial dentures is higher among the lower age groups, the rise with age in the percentage needing this type of correction is more gradual than the rise in the need for full dentures. At the age of 40 years, approximately 23 per cent of female patients and about 20 per cent of male patients need partial dentures. Beyond this age group, the need rises slowly and, at the age of 65 years, about 27 per cent of females as compared with 21 per cent of males are found to need partial dentures.

It is especially interesting to note that this is the only dental correction for which a larger percentage of females than males have need. A comparison of the need for lower full dentures with the need for partial dentures suggests a possible answer. It has been shown that more of the male group than of the female group needed full dentures. This difference is about equal to the difference by which the percentage of females needing partial dentures exceeds the percentage of males needing these dentures. It appears that since the dental condition of the females is somewhat better than the dental condition of the males, it is possible to make a larger percentage of corrections with partial dentures for females; whereas a larger percentage of males need full dentures.

Fixed Bridges (Fig. 7).—In the case of fixed bridges, the greatest need occurs among

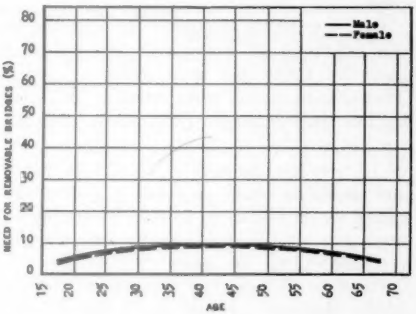


Fig. 8.—Percentage of those needing removable bridges among persons 15 years of age and over; by sex.

the younger age groups and decreases with age. This is the only other item of dental need that shares this characteristic with the need for fillings. The largest percentage of cases needing fixed bridges is found between the ages of 30 and 35 years. Approximately, 22 per cent of the patients of this age group need one or more fixed bridges. The percentages of patients in the younger age groups needing fixed bridges is somewhat smaller. Beyond the age of 35 years, the percentage of cases needing fixed bridges declined gradually until, at the age of 65 years, about 12 per cent of the males and about 4 per cent of the females needed fixed bridges.

The obvious explanation of the decrease in the need for fixed bridges with advancing age is that, with cumulative loss of teeth through extraction, with increasing years, the need for fixed bridges gives way to a need for partial and full dentures. It should be noted that again, comparatively, females have less need for fixed bridges.

Removable Bridges (Fig. 8).—The analysis of the need for removable bridges reveals, first of all, that compared with other types of dental corrections, this type is little used. The maximum percentage of cases for which removable bridges are recommended between the ages of 40 and 45 years does not exceed 10. One explanation for this slight use of removable bridges is probably to be found in the fact that it represents a rather expensive type of dental correction and does not always offer enough advantage over fixed bridges to justify the additional expense.

One interesting feature to be observed is the symmetry of the distribution of need over the entire age span above 15 years. The percentage of cases needing this correction rises gradually from about 4 at the age group 15-19 years, reaching a maximum of 10 between the ages of 40 and 45 years, and declining again to about 4 at the age group 65-70 years. It is also interesting to note that the need for males and females is almost exactly the same.

Need for Fillings and Extractions Among Males Between 15 and 44 Years of Age (Table 2).—Up to this point, the need for fillings and extractions has been discussed in terms of average need for groups as a whole. Also, the two items have been considered separately. This approach appears to be the best for obtaining an over-all picture, a summary of dental need. As has been suggested, by this means an idea is obtained of the need of the composite man and the composite woman representing a group. However, if the analysis is limited to this approach, certain other interesting aspects of the distribution of dental need are obscured.

In addition to knowing what the average need for fillings is for a group, it is interesting to know what percentage of persons in the group need no fillings at all and what percentage need one, two, three or more fillings. It is also interesting to have the same information on the distribution of need for extractions. A further step in the analysis is to relate these two items of need, to see what percentage of a group needs neither fillings nor extractions, the percentage needing one filling and no extractions, or needing one filling and one extraction, etc., for all combinations of the two needs.

Table 2 presents the type of analysis described above for males in the age group 15-45 years. This group was selected for analysis because of the current interest in health conditions among males of this age in connection with national defense planning. This table presents the percentage distribution of the number of fillings needed as related to the number of extractions needed. The total of the columns and the total of the lines give the percentage distribution of each item separately according to the number of fillings or extractions needed. Within the body of the table is given the percentage of patients in the group needing the particular number of fillings indicated on a given line and also needing the number of extractions shown in each column.

From the total column on fillings at the left of the table, it can be seen that 19 per cent of all patients in this group of 2,332 males between the ages of 15 and 44 years need no fillings, 8.5 per cent need one filling; 11 per cent need two fillings; etc. From the total line of extractions at the top of the table, it can be seen that 54.6 per cent of all the cases in this group need no extractions; 18.9 per cent need one; 9.7 per cent need two; 4.7 per cent need three, and 13.1 per cent need four or more.

From within the table, it can be seen, starting with the upper left hand corner, that 8.5 per cent of the patients need neither fillings nor extractions, 6.7 per cent need only one filling and no extractions, 6.9 per cent need two fillings and no extractions; etc. From the next column, it is seen that 3.3 per cent need no fillings, but one extraction; 0.9 per cent need one filling and one extraction; 1.9 per cent need two fillings and one extraction; etc.

In considering the percentages given on the table cumulatively, it is found that 50.2 per cent of the cases fall within the range of "12 fillings and 0 extractions." That is to

say, 50.2 per cent of the cases need between none and twelve fillings and need no extractions. By changing the range to include persons needing one extraction, it is found that 51.3 per cent of the cases fall within the range of six fillings and one extraction. By extending the range still farther, to include two extractions, it is found that 50.5 per cent of the patients fall within the range of five fillings and two extractions.

SUMMARY

The greatest single condition influencing the dental condition is found, as would be expected, to be the age of the patient. However, it is also found that, within the same age group, several conditions operate to make for differences in levels of need for various sections of the population.

It is found that the need for fillings and fixed bridges is inversely related to age; that is to say, with increasing age, the need for these corrections decreases. That is due to the fact that cumulative extractions lessen the possibility of placing fillings and make types of correctives other than fixed bridges necessary. Nearly all other types of dental correctives are directly related to age, increasing age being associated with increasing dental need. In general, the dental need of females is less than the dental need of males.

An analysis has also been made of the relationship between economic status and dental need and of the relationship between the length of time since the patient last visited the dentist and the dental need. A discussion of the findings of this section of the study will be published in a subsequent issue of THE JOURNAL.

The complete report of the study including all tables and illustrative charts and graphs has been published and is available for distribution. The price is 35 cents. Ask for a copy of "A Study of Dental Needs of Adults in the United States." Address your request to Melvin L. Dollar, Secretary, Committee on Economics, American Dental Association, 212 East Superior St., Chicago, Ill.

PAN AMERICAN DAY AT HOUSTON

TUESDAY, October 28, has been designated as Pan American Day by the President of the American Dental Association in honor of those who attend the Association Meeting from Pan American countries. A luncheon is to be given in the Pan American Room at the Rice Hotel on that day.

DANIEL F. LYNCH, *Chairman,*
Pan American Day Committee
1678 Primrose Road, N. W.
Washington, D. C.

American Dental Association

Houston, Texas — October 27-31, 1941

HOTEL RESERVATIONS

To secure hotel accommodations for the 1941 Meeting, consult the rate list on the next page and fill out the blank below. Mail this immediately to the hotel of your first choice or to the Housing Committee, Room 344, Rice Hotel, Houston, Texas. Confirmation will be sent to you by the hotel.

Second and third choices of hotel should be indicated. If the reservation cannot be made at any of the hotels of your choice, the Housing Committee will place you in as favorable a hotel as possible and will notify you.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed upon, please write or wire the hotel releasing the room, in order that it may be available for other members.

RAILROAD RATES TO HOUSTON

The railroads do not offer any special reduced rates to Houston on account of the American Dental Association Meeting. They do, however, offer winter rates to Houston from almost every city of the country, which are less than the regular railroad fares.

We suggest that local railroad agents be consulted for information.

HARRY B. PINNEY, *Secretary*,
American Dental Association.

APPLICATION FOR HOTEL ACCOMMODATIONS

AMERICAN DENTAL ASSOCIATION

Houston, Texas — October 27-31, 1941

HOTEL.....1st choice

HOTEL.....2nd choice

HOTEL.....3rd choice

Kindly reserve the following: ☐ Single room ☐ Double room ☐ Twin beds.

.....rooms with bath for.....persons $.....per room

.....rooms without bath for.....persons $.....per room

Arriving on October.....at.....a.m.....p.m.

ROOMS TO BE OCCUPIED BY:

NAME	ADDRESS IN FULL

NOTE TO HOTEL NAMED AS FIRST CHOICE: If the hotel of first choice is unable to make reservation requested, this application should be forwarded at once to the Housing Committee, Room 344, Rice Hotel, Houston, Texas.

SCHEDULE OF RATES

ALL ROOMS WITH BATH*

Hotels	Single	Double	Twin	Suites
AUDITORIUM, 701 Texas	$2.50–3–3.50	$3.50–4.50–5.50	$5	
BELMONT, 1308 Clay	$2	$3–3.50		
BRAZOS, 608 Preston	$2.50	$4	$4	
BRISTOL, 712 Travis	$2.50–3–3.50	$3.50–4–5	$4	
COTTON, Rusk and Fannin	$2–2.50–3	$3–3.50–4.50	$4	
DE GEORGE, 1418 Preston	$2	$3–3.50	$4.50–5.50	
FREDS HOTEL, 1006 Dallas	$1.50–2	$2–3	$2.50	
SAM HOUSTON, 1115 Prairie	$2.50–3–3.50	$4–5–6	$5–6	
HAMFORD APARTMENT, 919 Dallas	$1.50–2	$2–2.50		
HOUSTON CLUB, Commerce Building	$4–5–6	$6–7–8		
LAMAR, Main and Lamar	$3–4–5–6	$5–6–8–9	$5–7–8–9	$12–14–15–18–20–24
LAMAR ANNEX HOTEL, 916 McKinney	$2.50–3–4	$4–4.50–5–6	$5–6	
LEE, 1114 Polk	$2	$2.50–3	$3	
MACATEE, 519 Washington	$2–3–3.50	$3–4–5	$4–5	
BEN MILAM, 1521 Texas	$2.50–3–3.50	$3.50–4–4.50	$6	
MILBY, 902 Texas	$2–2.50–3	$3–3.50–4	$4–4.50–5	
OXFORD, 811 Lamar	$2	$3–4		
PARK, 610 Louisiana	$1.50	$2–2.50	$3	
WILLIAM PENN, 1423 Texas	$2–2.50–3–4	$3–3.50–4.50–5–5.50	$6	
PLAZA, 5020 Montrose	$3–3.50–4–5	$4.50–5–6–7	$6–7	$8–15
RHODES APARTMENT, 611 LaBranch	$2	$2.50–3		
RICE (Headquarters), Main and Texas	$3–4–4.50–5	$5–6–6.50–7–8	$6–7–8–9	$12–22–40
ROOSEVELT, 1111 Clay	$2	$2.50–3		
ROSSONIAN APARTMENT, 919 Fannin				$6–8
SAN JACINTO, 820 Main	$2.50–3–3.50–4	$4–4.50–5–5.50	$5.50–6–7–8	$10
STRATFORD, 414 Fannin	$2–2.50–3	$4.50–4–4.50	$4–4.50	
TENNISON, 801 Washington	$2	$3	$3.50	
TEXAS STATE, 720 Fannin	$3–4–5–6	$5–6–7–8	$6–7–8–9–10	$12–16–18–24
TRAVELERS, 114 Main	$1.50–2	$2–3		
WALEE, 1010 Caroline	$2	$2.50–3		
WARWICK, 5701 Main	$3.50–5	$3.50–5	$5–6	$6.50–7.50–9–11–18
WOODROW, 1412 Fannin	$2–2.50	$3–4–5		

*Rates on rooms without bath by request.

1941 BEGINS

A NEW CENTURY OF DENTAL PROGRESS

THE HERITAGE OF THE PAST IS THE SEED THAT BRINGS FORTH THE HARVEST OF THE FUTURE

AMERICAN DENTAL ASSOCIATION

VISIT HEALTH AND SCIENTIFIC EXHIBITS AT HOUSTON COLISEUM, OCTOBER 27-31

HOUSTON 1941

HUNTSVILLE RODEO

THE PRECONVENTION ENTERTAINMENT FEATURE

RODEO—all the thrills and action of the Southwest is telescoped in rodeo!

No matter how you pronounce it, it still spells the best in All-American entertainment.

Down in Houston, the Huntsville Prison Rodeo is pronounced the greatest of all rodeos — the wildest and the wooliest.

That's why the local arrangements committee has reserved a block of 500 seats for the A.D.A. members who will gather in Houston for the Association's Eighty-Third Annual Meeting, October 27-31.

The Huntsville Rodeo will be staged Sunday, October 26, and it is well to make your reservations now, by addressing W. T. Newton, chairman of the A.D.A. Entertainment Committee, 344 Rice Hotel, Houston, Texas. A.D.A. members and guests will make the 40

Bulldogging—a tough steer meets a tougher cowboy.

mile trip to Hunstville on a special, air-conditioned train and the cost will be only $2.

The rodeo is presented by the Texas State Prison and more than 175 performers vie with each other for the prizes. They include some of the most skilful and daring cowpunchers of the cattle country.

Each year, thousands of sports fans from all parts of the country are attracted to Huntsville by the rodeo spectacle. Its mad scramble combines thrills, chills and action in a never-to-be-forgotten experience. The men who perform—all of them inmates of the prison—are in the contest because they delight in the hardest-riding, toughest bulldogging that they can get. It's not a commercial entertainment—the nominal admission charges help maintain the prison's education and recreation fund.

Here's entertainment that really should not be missed. Pronounce it as you will, but be on hand for the Huntsville Rodeo!

Write today and reserve your seats.

THIRD MEDICODENTAL CONVENTION

THE Third Medicodental Convention was held in Mexico City, June 23-28, 1941, under the auspices of the School of Dentistry of the National University of Mexico.

The officers of the convention were: honorary president, General Manuel Avila Camacho, president of Mexico; president, Dr. Carlos M. Paz; secretary, Dr. Samuel Fastlicht; treasurer, Dr. Guillermo S. Gamboa; honorary president, Dr. Spencer R. Atkinson, Pasadena, Calif.; honorary vice presidents: The Honorable Josephus Daniels, ambassador of the United States to Mexico; Dr. Victor Fernandez Manero, chief of the Health Department; Lic. Mario de la Cueva, rector of the National University of Mexico; Dr. José Aguilar Alvarez, dean of the School of Medicine of the National University of Mexico; Dr. Aurelio Galindo, dean of the School of Dentistry of the National University of Mexico; Dr. Ramon Cordova, dean of the School of Dentistry of the University of Guadalajara; Dr. Nathan B. Van Etten, New York, N. Y., president of the American Medical Association; Dr. Oren Oliver, Nashville, Tenn., president-elect of the American Dental Association; Dr. Claude R. Wood, Knoxville, Tenn., president of the American Association of Orthodontists, and Dr. Jose J. Rojo, president of the Mexican Dental Federation.

The convention lasted five days, during which numerous essays and clinics were presented.

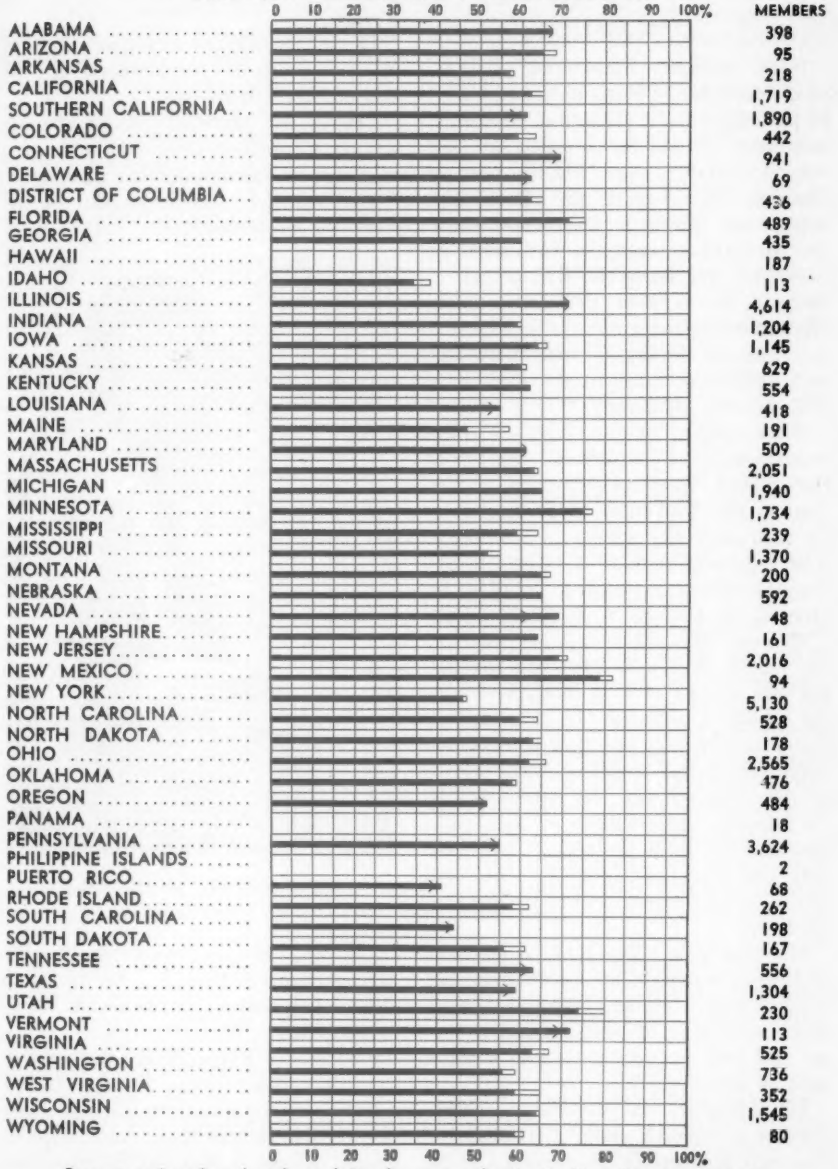
Among the Americans present were Drs. Oren Oliver, Claude R. Wood, Charles W. Lincoln and Don J. Aubertine, who were elected honorary members of the Mexican Dental Federation and received diplomas of recognition from the convention. Dr. Spencer R. Atkinson, honorary president of the Mexican Orthodontic Association, was awarded an engraved silver plate from the Universities of Mexico and Southern California.

The entire meeting was a notable event in dentistry toward the promotion of scientific and social relations among the dental societies from the United States and Latin American countries.

SAMUEL FASTLICHT
Av. Madero, 40
Mexico, D. F.

Membership Page

PERCENTAGE OF DUES RECEIVED IN CENTRAL OFFICE AS OF JULY 31, 1941 AS COMPARED TO 1940 MEMBERSHIP



Percentage based on dental population figures supplies by the State Society Secretaries

1941 percentage. 1940 percentage.

OBITUARIES

JOHN ALBERT MARSHALL
(1884-1941)

JOHN ALBERT MARSHALL, D.D.S., Ph.D., professor of biochemistry and dental pathology at the College of Dentistry, University of California, died in San Francisco May 7, 1941. He was born in Chicago, Ill., August 30, 1884. The family later moved to California, where Dr. Marshall entered the University of California, receiving the B.S. degree in 1907 in the field of chemistry. After graduation, he was employed as a laboratory assistant in organic chemistry and an assistant in music in the University of California, 1906-1907.

From 1907 to 1909, he engaged in the manufacture of explosives. He spent the period 1909 to 1910 as a student at the University of Berlin, where he continued his studies in chemistry. The following year, he returned to the manufacture of explosives. In 1913, he entered the College of Dentistry of the University of California. He received the D.D.S. degree in 1916 and was appointed as instructor in biochemistry in the school of medicine. In 1917, he was appointed assistant professor of biochemistry and dental pathology. He served in this capacity until his promotion to an associate professorship in 1921. Dr. Marshall was made professor of biochemistry and dental pathology in 1926, and served in that capacity until the time of his death.

His interest in research lay in the field of diet and nutrition, bone pathology and focal infection. He was keenly interested in the integration of medicine and dentistry and had recently started to write a book on dental medicine.

Dr. Marshall was appointed special director of research under a grant of the Research Institute of the National Dental Association, 1917 to 1924. He was associate editor of the *Journal of Dental Research*.

During the war, he served as a captain in the ordnance department of the United States Army.

One of Dr. Marshall's major interests was the Council on Dental Therapeutics, of which he was an energetic member.

Dr. Marshall was a member of the following professional and honorary societies: the American Association for the Advancement of Science; the American Dental Association, the American Medical Association, Sigma Xi, Epsilon Alpha, the Society of Experimental Biology and the International Dental Federation, and a Fellow of the American Medical Association, the International Association of Dental Research and the International College of Dentists.

JOHN ALBERT MARSHALL
(1884-1941)

Dr. Marshall's interests and activities were not alone in the field of dentistry, but in that of music as well. In addition to his many scientific and professional articles, one finds a number of essays written for the lay public, most of them educational and having to do with nutrition and the prevention of dental disease.

It was very evident that his major interest was dental education. And it was here that he found an outlet for the energy and enthusiasm that was his outstanding characteristic.

WILLARD C. FLEMING.

ABRAHAM LINCOLN GREENFIELD, D.D.S.

(1898-1941)

ABRAHAM LINCOLN GREENFIELD, professor of roentgenology and head of that department at the New York University, College of Dentistry, died suddenly of a heart attack at his summer home in Far Rockaway, Queens, Friday, July 25, 1941. He was born in New York City, February 15, 1898.

His preparatory education was received at the DeWitt Clinton High School in New York City and he was a graduate of the New York University, College of Dentistry, in 1919. He was immediately appointed to the faculty of his Alma Mater with the rank of instructor. In 1925, he was chosen head of the department of radiology, and, in 1938, he became a full professor.

Dr. Greenfield was dental radiologist at the Montefiore Hospital, New York, consulting orthodontist at the Broad Street Hospital, New York, visiting lecturer to the New York University, College of Medicine and lieutenant commander in the Dental Corps, United States Naval Reserve. He was also past president of the New York University Dental School Alumni Association and a past chairman of the Pathodontia Section of the First District Dental Society of New York.

Dr. Greenfield was an international authority in the field of roentgenology and also a well-known orthodontist. He was in constant demand as a lecturer and clinician by all of the principal dental societies in the United States and had also lectured in Europe. He was the author of "Interpretation of Dental Roentgenograms" and "X-Ray Technic and Interpretation of Dental Roentgenograms."

He was a member of the American Dental Association, Omicron Kappa Upsilon, honorary dental fraternity, and Sigma Epsilon Delta fraternity.

In 1930, Dr. Greenfield married Miss Frances Oser of New York, who survives, with two children, a son, Kenneth Martin, and daughter, Ann Louise.

S. S. WALD.

WILLIAM HOPKINSON, D.D.S.

(1863-1941)

WILLIAM HOPKINSON died Wednesday, July 23, 1941, at Milwaukee, Wis.

He was born in Leeds, England, and came to this country at the age of 18 years. At the age of 39, he entered the Milwaukee Medical College (now Marquette) and from this institution he received the D.D.S. degree. He established himself in practice in Milwaukee.

Dr. Hopkinson was one of the outstanding men in the dental profession of Wisconsin. For thirty-four years, he was connected with the dental school of Marquette, finally becoming professor of histology, a position which he held until 1934, when he retired from active teaching duties.

Dr. Hopkinson was actively interested in all phases of dentistry and, in addition to his association in a teaching capacity with Marquette, he was instrumental in the organization of the Milwaukee Free Dental Clinic in the public schools,

which later became the Oral Hygiene Division of the Milwaukee Health Department.

He was president of the Milwaukee County Dental Society, in 1910; President of the North Side Dental Society, in 1912; president of the Wisconsin State Dental Society, in 1914, and President of the Marquette University Dental Alumni Association, in 1918.

He was, throughout his career, held in the highest esteem by his dental associates in Milwaukee. He was one of the first men to be given a complimentary dinner by the state society as a mark of respect of the society.

Dr. Hopkinson was a Mason and a member of Omicron Kappa Upsilon, honorary dental fraternity, and of Psi Omega.

DEATHS

ARNOLD, F. M., Decatur, Ill.; University of Illinois School of Dentistry, 1904; died July 22; aged 65.

CATRON, HENRY W., Knoxville, Tenn.; Atlanta-Southern Dental College, 1918; died July 22; aged 52.

CHESNUTT, EARL E., Dormont, Pa.; Temple University School of Dentistry, 1905; died August 6.

CLAYES, STANLEY A., Boston, Mass.; Harvard University Dental School, 1919; died May 18.

HAHN, EDWARD N., Chicago, Ill.; Chicago College of Dental Surgery, 1918; died July 11; aged 55.

HARMKE, CARL W., Chicago, Ill.; Northwestern University Dental School, 1924; died July 6; aged 38.

KEITH, IVAN C., Mattapoisett, Mass.; Tufts College Dental School, 1904; died April 9; aged 64.

KLEIN, BARNETT FRANCIS, Boston, Mass.; Tufts College Dental School, 1923; died May 12.

KREPPEL, CHARLES F., Boston, Mass.; Tufts College Dental School, 1899; died April 23.

MANGOLD, ARTHUR W., Chicago, Ill.; Chicago College of Dental Surgery, 1929; died July 2; aged 41.

PATTERSON, W. D., Cedar Rapids, Iowa; Philadelphia Dental College, 1879; died May 14; aged 87.

PFENNIG, ERNST, Chicago, Ill.; Northwestern University Dental School, 1888; died June 28; aged 75.

ROSEN, JOSEPH J., Boston, Mass.; Tufts College Dental School, 1922; died April 23.

SWEETNAM, JOHN L., Manistee, Mich.; died May 30; aged 79.

WALTERS, F. L., Mattoon, Ill.; University of Louisville, School of Dentistry, 1899; died May 19; aged 67.

WOJTALEWICZ, JULIUS A., Chicago, Ill.; Chicago College of Dental Surgery, 1917; died May 16; aged 52.

CURRENT LITERATURE

The Action of Fluorine in Limiting Dental Caries

By J. F. Volker and B. G. Bibby

Recent researches into the relationship between fluorine and dental caries point to the conclusion that a direct limiting influence exists independently of the production of mottling of enamel. Evidence of this influence on caries is presented from field studies by authoritative investigators throughout the world. From chemical analysis of carious and non-carious enamel and from observations made on the caries susceptibility of rats fed a coarse particle diet, the fact that the ingestion of fluorine can limit susceptibility to dental decay is established, and it leads to a practical method of caries prevention. However, the method of action of fluorine must be determined.

Assuming that the initial lesion of tooth decay is decalcification of the surface enamel by acid products of bacterial fermentation, three possible conditions may be influenced by the presence of fluorine: salivary action, acid formation and tooth resistance. Field studies and animal experiments reveal the relative unimportance of the saliva. Since the enzymatic activity of the saliva may be considered the first step in bacterial acid production, and since this activity is practically unaffected by fluorine of from 0.76 to 760 parts per million (McClure), there is little or no immunizing effect. Further, findings in connection with the reduction of oral bacteria or interference with their activities by fluorine are inconclusive when applied to the human mouth. However, a definite reduction in acid formation on fluorosed teeth observed may be explained by fluorine combination with or absorption by the tooth itself. There is evidence that the presence of fluorine in the drinking water, while in contact with the enamel on being taken into the mouth, serves to increase tooth resistance by combining with the surface enamel. The use of dentifrices and mouth washes containing fluorine of about five parts per million is suggested for extensive trial under well-controlled clinical conditions.—*Medicine,* 20:211-227, May 1941.

H. B. McCauley.

Saliva and Enamel Decalcification. VI. Predisposing Caries Factors

By J. T. Gore

One of the conditions conceded to predispose one to dental caries is the H-ion concentration or carbohydrate content of the saliva. In addition to a carbohydrate concentration due directly to the diet, there is evidence that the mucin of saliva contains a polysaccharide, which tests indicate may be glycogen, in combination with a protein. It is assumed, because a considerable amount of insulin is found in the salivary glands and there is a marked consumption of glucose from the blood passing through these glands, that this polysaccharide is polymerized from the blood glucose in the salivary glands and secreted into the mouth. Hence, insulin is considered a factor in caries, and changes in relative immunity are laid to changes in the activity of the islands of Langerhans in the pancreas. Thus, the susceptibility of the growing child is contributed to by intense pancreatic activity, whereas the decreasing sugar tolerance of the ageing indicates a decreasing production of insulin and increasing caries immunity.—*J. D. Res.,* 20:107-115, April 1941.

H. B. McCauley.

Periodontal Sepsis in Relationship to Systemic Disease

By Russel A. Sand

In a brief account of the value of eliminating all possible sources of oral sepsis, including the pulpless tooth, periodical lesions and paradental lesions, no attempt is made to classify these lesions with respect to their importance as foci of infection. Actual clinical experience has shown that the elim-

ination of oral foci has definitely improved or removed symptoms of arthritis, myositis, nonspecific gastro-intestinal disturbances, cholecystitis, acne and spastic constipation.—*D. J. Australia,* 13:231, May 1941.

A. PEARSON.

Actinomycosis Treated with Sulfanilamide

By E. E. WILKINSON

THE past treatment of actinomycosis has been, in general, quite unsatisfactory. The usual means of treatment are surgery, iodides, copper sulfate, the x-rays and colloidal gold. In a case of widespread actinomycosis of the chest wall, lung, cheek, hip and metatarsal bone, sulfanilamide was employed over a long period of time with good results.—*J. Pediatrics,* 18:805, June 1941.

A. PEARSON.

Diagnosis of Pyorrhea with Special Reference to the Location and Form of the Gingival Crevice Correlated with Radiographic Findings

By D. J. MARTIN

THE question of pyorrhea is discussed in relation to its means of diagnosis. Two facts that can be relied on are the depth of the gingival crevice and the condition of its base, and the roentgenographic appearance as correlated with clinical findings. Concerning the first, the variation, within physiologic limits, of the gingival crevice must be borne in mind. A true pocket has formed only when there is a definite break in the base of the gingival crevice.

Concerning the second, distinction must be made between a thickening of the pericementum due to infection and excessive stress or trauma.—*D. J. of Australia,* 13:201, May 1941.

A. PEARSON.

Surgical Correction of Mandibular Prognathism

By GORDON B. NEW and JOHN B. ERICH

THE methods which are most commonly employed in correcting mandibular prognathism may be given as: (1) bilateral resection of a segment of the mandible in the bicuspid or first molar region; (2) bilateral resection of a portion of the body of the mandible near the angles; (3) osteotomy of the ascending rami above the mandibular foramina, and (4) osteotomy through both necks of the mandible in the bicuspid or first molar regions. The authors prefer the last by the "transmucoperiosteal" method for the following reasons: 1. The sawing can be accomplished with much greater precision. 2. When operating by the closed method, the surgeon often accidentally produces a small, perhaps unnoticeable, nick or tear in the oral mucous membrane and thus contaminates the wound. 3. With adequate drainage, osteomyelitis does not develop as a result of the open method. 4. Osteonecrosis is more likely to occur if the bone is stripped of its periosteum. 5. By means of the open method, it is technically much easier to preserve the mandibular nerve and vessels.—*Am. J. Surg.,* 53:2-12, July 1941.

JAMES T. GINN.

Comparative Measurements of Salivary pH

By GEORGE D. WESSINGER

THE salivary pH of fifty patients was measured by means of the glass and quinhydrone electrodes. It was found that the quinhydrone method gave slightly lower results, the greatest deviation being 0.13 units, and the average for fifty measurements, about 0.08. It was also found that the differences in salivary pH as measured by the two methods was not constant for any one individual, but varied from day to day.—*J. D. Res.,* 20:123-128, April 1941.

JAMES T. GINN.

Studies on Masticatory Efficiency. 1. Review of Literature

By REIDAR F. SOGNNAES

IN this, the first of a series of articles, a review is given of the studies made on food partition during mastication, and the significance of the teeth as part of the gastro-intestinal tract in promoting digestion and utilization of food.

No studies were found on the masticatory efficiency of animals.

Disagreement exists as to the importance of masticatory efficiency in the utilization of food. Some workers have shown that insufficient mastication is responsible for

undigested food in feces, but according to the bulk of the evidence, the number and condition of teeth play no rôle in food utilization as far as modern diet is concerned.

Methods to measure the efficiency of the teeth in masticating food have been developed. Maintenance of healthy teeth and replacement of lost teeth seem favorable in the mechanical breaking down of food.—*Am. J. Orthodontics*, 27:309, June 1941.

FINN BRUDEVOLD.

Pain in Cancer of the Face, Jaws and Neck

By DONALD MUNRO

THIS is a study of thirty cases of cancer of the face, jaws and neck. It is believed that irradiation of the malignant area is a significant factor in the causation of the pain that develops in these areas. There is little relief to be expected from either medical or neuro-surgical procedures that are initiated after the cancer has metastasized. It is suggested that surgical denervation of the cancer-bearing area in the face, throat, neck and jaws be performed as the first step in the treatment of the malignant growth, not only as a prophylaxis against later pain, but also as an aid to greater efficiency in the therapy of the cancer because of the associated local anesthesia thus produced.—*New England J. Med.*, 224:1049-1053, June 19, 1941.

JAMES T. GINN.

The Importance of Case History Taking in Oral Surgery

By REED O. DINGMAN

IT is a not infrequent tendency to attempt diagnosis by consideration of the physical and laboratory findings alone, with a disregard for the history. Since oral surgery is a health service closely paralleling the specialties of medicine, it cannot develop independently of the time-proven, medical methods of diagnosis. Therefore, the history is of special importance to the oral surgeon, since he does not have the benefit of a general physical examination and extensive laboratory studies usually available to the physician,

Once experience has been obtained, history taking can be modified to fit the case. Leading questions will determine the direction of questioning and so separate the relevant from the irrelevant. Case histories should be written so that careful study and appraisal are possible upon their completion. Standard plain white 9 by 12 inch history sheets are best suited to the practitioner's need.

For the less experienced practitioner, or for those having cases of obscure complaints, the following outline is suggested.

I. Chief complaint
II. Present illness
III. Past history
  (A) General health
  (B) Childhood diseases
  (C) Other diseases and outcome
  (D) Injuries and operations
  (E) History of each system
IV. Family history
V. Diagnosis from history

In addition, valuable observations upon the mental and physical state can be made during the question period. A carefully taken, duly analyzed history is a basis on which to establish a tentative diagnosis before proceeding to the physical examination.

Several cases illustrating the importance of accurate case histories are furnished.—*Am. J. Orthodontics*, 27:291, June 1941.

J. EDWARD GILDA.

The Oral Surgeon's Responsibility in Diagnosis

By EDWARD REITER

RESPONSIBILITY, in its broadest sense, means that the oral surgeon is obliged to see that no harm comes to his patient. While an accurate diagnosis is unquestionably necessary to achieve this end, proper therapeutic measures are equally important. By virtue of the surgeon's experience and knowledge, all possible developments must be anticipated and treated accordingly. Consideration is turned to infections of the oral and cervical regions in which improper treatment, not improper diagnosis, was responsible for harmful results. Four cases are presented in which improper management had untoward results. The author believes that in purulent infections, early drainage is necessary and that, in many instances, adequate drainage can be established only by removing the offending tooth. It is imperative to differentiate between an inflam-

matory process of the soft tissues and an acute purulent infection. Intimate knowledge of the anatomy of the neck added to good surgical judgment will aid in assuring the patient's welfare.—*Am. J. Orthodontics*, 27:300, June 1941.

J. EDWARD GILDA.

Treatment of Thrush with Silver Nitrate

By JAMES L. HAMNER

THE editor has outlined a method advocated by Millet for the simple and effective treatment of thrush. Balls of cotton wool are tied with string and soaked in 1 per cent solution of silver nitrate. The patient is given one to suck at four-hour intervals until three are used, carbonated water being taken in the interim. At this time, after twelve hours, the thrush has disappeared completely from the tongue and palate and the lingual mucous membrane is clean. No difficulty is encountered in sucking these silver nitrate balls by adults. They may be flavored for children. No nausea is experienced.—*South. Med. & Surg.*, 103:342, June 1941.

N. S. SIMMONS.

Nutritional Stomatoglossitis Among the War Refugees in China

By P. T. KUO and M. S. HUANG

TWO HUNDRED THIRTY-SEVEN cases of nutritional stomatoglossitis, attributable to a diet restricted to rice or congee for two years, as a result of the existing hostilities, were studied in Shanghai.

The signs and symptoms of these deficiency syndromes are an early depression of salivary secretion, with resulting dryness of the mouth and numbness of the lips and tongue. The tongue and buccal mucosa become acutely inflamed, with increased salivation. The mouth is sore, especially when ulcers are present. The final stage involves a degeneration of the lingual papillae and epithelium, sometimes including the buccal mucosa. The mouth again becomes dry and taste sensation is lost. This is accompanied by loss of appetite and, if treatment is not quickly instituted, the prognosis is poor. There may also be cracks and fissures about the corners of the mouth.

The commonly associated nutritional glossitis is divided into six groups by the authors:

1. Marginal inflammation, earliest variety. Inflammation of the margins and tip of the tongue. The lesions are red, swollen and tender, with prominent papillae.

2. Indentations of the tongue. Indenting or scalloping of the tongue due to pressure against teeth following swelling and loss of vitality.

3. Generalized inflammation. Diffuse edema and hyperemia and prominent papillae.

4. Partial atrophy. Part of the tongue glossy with atrophy of lingual epithelium and papillae, in contrast with remaining areas.

5. Atrophic type. Complete denudation of lingual papillae, leaving the tongue a pale red and smooth.

6. Pellagrous stomatitis. A fiery red tongue with or without shallow ulcers. Tenderness and salivation. Rapid response to nicotinic acid therapy (twenty-four—forty-eight hours).

The therapy consisted of an improved dietary régime (beef, pork, eggs, liver, etc.), and nicotinic acid and liver extract therapy.

Among the improvements noted by the authors as following therapeutic measures was regeneration of the pale denuded lingual epithelium and degenerated papillae in four or five days, usually complete in from ten to thirty-three days, depending on the severity. The appetite improves simultaneously.—*Chinese M. J.*, 59:430, May 1941.

N. S. SIMMONS.

Domestic Water and Dental Caries. 1. A Dental Caries Study, Including L. Acidophilus Estimations of a Population Severely Affected by Mottled Enamel and Which for the Past Twelve Years Has Used a Fluoride-Free Water

By H. TRENDLEY DEAN, PHILIP JAY, FRANCIS A. ARNOLD, JR., and ELIAS ELVOVE

THIS is a recent study made at Buxite, Ark., a community in which there is mottling of the enamel, owing to the high fluorine content of the drinking water. In 1928, the water supply was changed to a fluoride-free one. It was found that Buxite pulpils with moderate to severe mottling of enamel and exposed to the fluoride-free

waters showed markedly less dental caries than a comparable group of Benton pupils without mottled enamel and who had always used fluoride-free waters. This limited immunity from dental caries is apparently dependent on the presence of macroscopic mottled enamel, because children born since 1928 and free of mottled enamel showed a low dental-caries experience. However, the lowest age group at Buxite showed the highest incidence of dental caries in spite of the fact that they had been exposed to the risk of caries for the shortest period of time. The *L. acidophilus* counts correspond to the caries activity in the various groups.—*Pub. Health Rep.*, 56:365-381, February 28, 1941.

JAMES T. GINN.

Effect of Topical Fluorine Application on Experimental Rat Caries

By REIDAR F. SOGNNAES

THIRTY normal rats were placed upon a coarse-corn, caries-producing diet at 50 days of age. Sixteen rats received a local application of fluorine. Ten of these rats were treated during the first days of the experimental period and subsequently at intervals of two weeks. Six rats were treated with fluorine only during the middle and latter part of the experimental period. It was found that the number of teeth affected by caries, per animal, was twice as high in the control group as in the group that received topical applications of fluorine from the beginning of the experiment. In the group that received fluorine only in the middle and latter part of the experimental period, the difference was less apparent. An apparatus designed by the author facilitated the topical application of fluorine to the teeth.—*Brit. D. J.*, 70:433-437, June 16, 1941.

JAMES T. GINN.

Natural Vital Staining of the Teeth of Infants and Children

By PAUL E. BOYLE and MAURICE DINNERMAN

THIS is a report of the clinical and histologic observations on the natural staining of teeth of three persons who were jaundiced during infancy. Clinically, the teeth were various shades of green. In each case, natural vital staining occurred in those teeth that were forming during the period of jaundice. In two of the cases, the bile stain in the deciduous teeth showed no diminution in intensity up to the time that they were exfoliated. The third patient died at 6½ months and the unerupted teeth were examined postmortem. Gross or microscopic hyperplasia of enamel or dentin was not associated with the zones that were stained by bile. Histologically, the staining was found to demarcate particular incremental zones of tooth substance, which, especially in the dentin, could be correlated with the clinical history of the variations in severity of jaundice. The direct reaction of the enamel to the diazo reagent of the van den Burgh test was observed.—*Am. J. Orthodontics*, 27:377-782, July 1941.

JAMES T. GINN.

Ueber die Gefahren bei Verwendung festsitzender aktiver orthodontischer Apparate (Dangers of Using Fixed Active Orthodontic Appliances)

By KARL HAUPL

TEETH under orthodontic treatment are acted upon by the forces of the appliances as well as by functional irritants. The author believes that the functional irritants are the fundamental cause of the histologic changes going on during tooth movement, and that the continued pushing by fixed appliances will not lead to bone regeneration or resorption. On two dogs, the motor nerves to the muscles of the tongue, lip and chin were disconnected to prevent any function of the masticatory apparatus. Orthodontic appliances were placed on the teeth of one, while the teeth of the other were put under intermittent pressure with the help of woodsticks. After forty-eight hours, the paradentium of the first dog showed no histologic changes, while the other showed pronounced tissue changes, with bone resorption and regeneration.

Six clinical cases of previous unsuccessful orthodontic treatment are discussed and the dangers of forcing teeth into new positions by fixed appliances are stressed. Finally, the belief is expressed that fixed appliances eventually will be replaced by removable activators, as advocated by Andresen.—*Deutsche Zahnärztl. Wchnschr*, 44:277, May 9, 1941.

FINN BRUDEVOLD.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

AMERICAN ACADEMY FOR PLASTICS RESEARCH IN DENTISTRY, Houston, Texas, October 26.

AMERICAN ACADEMY OF PERIODONTOLOGY, Houston, Texas, October 23-25.

AMERICAN ACADEMY OF RESTORATIVE DENTISTRY, Houston, Texas, October 25-26.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF ORAL DIAGNOSIS, New York, N. Y., November 13-14.

AMERICAN ASSOCIATION OF DENTAL EDITORS, Houston, Texas, October 25.

AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTS, Houston, Texas, October 26-28.

AMERICAN COLLEGE OF DENTISTS, Houston, Texas, October 26.

AMERICAN CONGRESS OF PHYSICAL THERAPY, Washington, D. C., September 1-5.

AMERICAN DENTAL ASSISTANTS ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN DENTAL ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN OCCUPATIONAL THERAPY ASSOCIATION, Washington, D. C., September 1-5.

AMERICAN PUBLIC HEALTH ASSOCIATION, Atlantic City, N. J., October 14-17.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY, New York, N. Y., October 27.

AMERICAN SOCIETY OF DENTISTRY FOR CHILDREN, Houston, Texas, October 26-28.

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS, Houston, Texas, October 23-25.

ASSOCIATION OF MILITARY SURGEONS OF THE UNITED STATES, DENTAL SECTION, Houston, Texas, October 28.

UNIVERSITY OF BUFFALO SCHOOL OF DENTISTRY ALUMNI ASSOCIATION, Buffalo, N. Y., October 14-16.

DELTA SIGMA DELTA, Houston Texas, October 27.

DISTRICT OF COLUMBIA DENTAL SOCIETY, second and fourth Tuesdays in each month from October to June at the United States Public Health Service Auditorium, Washington.

GREAT LAKES SOCIETY OF ORTHODONTISTS, Ann Arbor, Mich., November 3-4.

INTERNATIONAL COLLEGE OF DENTISTS, Houston, Texas, October 26.

METROPOLITAN DENTAL SOCIETIES OFFICERS' CONFERENCE, Houston, Texas, October 29.

MIDCONTINENT DENTAL CONGRESS, St. Louis, Mo., November 17-19.

GREATER NEW YORK DENTAL MEETING, December 1-5, New York.

ODONTOLOGICAL SOCIETY OF WESTERN PENNSYLVANIA, Pittsburgh, November 11-13.

PSI OMEGA, Houston, Texas, October 27.

SOUTHERN SOCIETY OF ORTHODONTISTS, Raleigh, N. C., September 29-30.

STATE SOCIETIES

September

Southern California, at Los Angeles (8-10)
Hawaii, at Honolulu

November

Ohio, at Columbus

December

Florida, at Hollywood (8-10)

STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, December 15. Kenneth I. Nesbitt, 515 Van Ness Ave., San Francisco, Secretary.

Indiana, at Indianapolis, October 6-10. D. Gordon Lamb, 819 Chamber of Commerce Bldg., Indianapolis, Secretary.

Iowa, at Iowa City, December 15-19. Harry G. Bolks, Sioux City, Secretary.

New Jersey, December 8-13. Walter A. Wilson, 150 E. State St., Trenton, Secretary.

Ohio, at Columbus, October 20. Earl D. Lowry, 79 E. State St., Columbus, Secretary.

Wisconsin, at Milwaukee, December 15-19. S. F. Donovan, Tomah, Secretary.

AMERICAN ACADEMY FOR PLASTICS RESEARCH IN DENTISTRY

THE annual meeting of the American Academy for Plastics Research in Dentistry will be held October 26 at 2 p.m. in the Assembly Room of the Houston Chamber of Commerce. Application for admission to the meeting may be made through the secretary's office.

LAMAR W. HARRIS, *Secretary,*
25 East Washington St.,
Chicago, Ill.

AMERICAN ACADEMY OF PERIODONTOLOGY

THE American Academy of Periodontology will hold its twenty-eighth annual meeting at the Lamar Hotel, Houston, Texas, October 23-25.

RAYMOND E. JOHNSON, *Secretary,*
824 Lowry Medical Arts Bldg.,
St. Paul, Minn.

AMERICAN ACADEMY OF RESTORATIVE DENTISTRY

THE American Academy of Restorative Dentistry will meet at the Rice Hotel, Houston, Texas, October 25-26.

W. S. TUCKER, *Secretary,*
940 Canal Bldg.,
New Orleans, La.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF ORAL DIAGNOSIS

THE eighth annual congress of the American Association for the Advancement of Oral Diagnosis will be held in New York, N. Y., November 13-14, at the New York Academy of Medicine. The papers, discussions and exhibits will cover oral diagnosis with special attention to the basic sciences. Members of the medical and the dental professions in the United States and countries of the Western Hemisphere are invited to attend and can obtain programs by communicating with the secretary.

H. JUSTIN ROSS, *Secretary,*
515 Madison Ave.,
New York, N. Y.

AMERICAN ASSOCIATION OF DENTAL EDITORS

THE American Association of Dental Editors will hold its annual meeting in the Rice Hotel, Houston, Texas, October 25. An all day program has been arranged and editors are urged to attend.

O. W. BRANDHORST, *Secretary,*
4952 Maryland Ave.,
St. Louis, Mo.

AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTS

THE annual meeting of the American Association of Public Health Dentists will be held in the Lamar Hotel, Houston, Texas, October 26-28.

FRANK C. CADY, *Secretary,*
U. S. P. H. S. Hospital,
Lexington, Ky.

AMERICAN COLLEGE OF DENTISTS

THE Houston convocation of the American College of Dentists will be held in the Rice Hotel, October 26, with morning, luncheon, afternoon and evening sessions.

O. W. BRANDHORST, *Secretary,*
4952 Maryland Ave.,
St. Louis, Mo.

AMERICAN CONGRESS OF PHYSICAL THERAPY

THE twentieth annual scientific and clinical session of the American Congress of Physical Therapy will be held September 1-5 at the Mayflower Hotel, Washington, D. C. The mornings will be devoted to the annual instruction course and the afternoons and evenings to the scientific and clinical sessions. The seminar and convention proper will be open to all physicians and qualified technicians. For information concerning the seminar and preliminary program of the convention proper, address the American Congress of Physical Therapy, 30 North Michigan Ave., Chicago, Ill.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

THE seventeenth annual session of the American Dental Assistants Association will

be held in Houston, Texas, October 27-31. For further information, address

AILEEN M. FERGUSON,
General Secretary,
709 Centre St.,
Jamaica Plain, Mass.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

THE eighteenth annual meeting of the American Dental Hygienists' Association will be held in Houston, Texas, October 27-31. Headquarters, Lamar Hotel.

A. REBEKAH FISK, *Secretary,*
General Dispensary, U. S. Army,
Washington, D. C.

AMERICAN OCCUPATIONAL THERAPY ASSOCIATION

THE twenty-fifth annual meeting of the American Occupational Therapy Association will be held at the Mayflower Hotel, Washington, D. C., September 1-5. A combined meeting of the association with the American Congress of Physical Therapy will be held September 3. For further information, address

(MRS.) META R. COBB,
175 Fifth Ave.,
New York, N. Y.

AMERICAN PUBLIC HEALTH ASSOCIATION

THE seventieth annual meeting of the American Public Health Association will be held in Atlantic City, N. J., October 14-17. Headquarters, Convention Hall; residence headquarters, Hotel Traymore. Ira V. Hiscock, professor of public health at the Yale School of Medicine, will speak at the luncheon session of the oral health group. Subject: "How Important Is the Dental Health Program? Nationally? Locally?"

WILLIMINA RAYNE WALSH,
Associate Secretary,
1790 Broadway,
New York, N. Y.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

THE fall meeting of the American Society for the Advancement of General Anesthesia in Dentistry will be held October 27 at the Midston House, Thirty-Eighth Street and Madison Avenue, New York, N. Y. Paul M. Wood, M.D., assistant clinical professor of anesthesia, New York Medical College, will speak on "Management of Emergencies in Dental Anesthesia." The scientific session at 8:30 p.m. will be preceded by an informal dinner at 7 o'clock, to which the profession is invited.

M. HILLEL FELDMAN, *Secretary,*
730 Fifth Ave.,
New York, N. Y.

AMERICAN SOCIETY OF DENTISTRY FOR CHILDREN

THE annual meeting of the American Society of Dentistry for Children will be held in the Lamar Hotel, Houston, Texas, October 26-28. For additional information, address

R. M. ERWIN, JR., *Secretary,*
613 Corbett Bldg.,
Portland, Ore.

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS

THE twenty-second annual meeting of the American Society of Oral Surgeons and Exodontists will be held in Houston, Texas, October 23-25, with headquarters at the Texas State Hotel.

HARRY BEAR, *Secretary,*
410 Professional Bldg.,
Richmond, Va.

ASSOCIATION OF MILITARY SURGEONS OF THE UNITED STATES DENTAL SECTION

THE annual dinner of the Military Surgeons will be held October 28 at 7 p.m. in the Rice Hotel, Houston, Texas. All dental officers on active duty with the Federal Services are invited. For reservations, notify L. W. Maly, chairman, Dinner Committee, Camp Hulen, Texas.

R. C. CRAVEN, *Secretary.*

UNIVERSITY OF BUFFALO SCHOOL OF DENTISTRY ALUMNI ASSOCIATION

THE forty-first annual meeting of the University of Buffalo Dental Alumni Association will be held October 14-16 at Hotel Statler, Buffalo. The Eighth District Dental Society of the State of New York is cooperating in the development of the program. All ethical practitioners are invited.

JOHN D. LYNCH,
Chairman of Publicity.

DELTA SIGMA DELTA FRATERNITY

THE fifty-seventh annual meeting of the Supreme Chapter of Delta Sigma Delta will be held at the Texas State Hotel for the morning and afternoon sessions and the annual banquet at the Rice Hotel, October 27. The first session, at 9:30 a.m., will be followed by a complimentary luncheon to the members. At the afternoon session immediately following, a business meeting of the Supreme Chapter will be followed by the initiation of any candidates who may be presented. The annual banquet will be held at 6:30. Women are invited. Members registering for the luncheon and banquet must present membership cards.

R. HAMILL D. SWING, *Supreme Scribe.*

GREAT LAKES SOCIETY OF ORTHODONTISTS

THE Great Lakes Society of Orthodontists will meet November 3-4 at Ann Arbor, Mich.

RICHARD E. BARNES, *Secretary,*
1704 Republic Bldg.,
Cleveland, Ohio.

INTERNATIONAL COLLEGE OF DENTISTS

THE 1941 convocation of the U. S. A. Section of the International College of Dentists will be held at the Rice Hotel, Houston, Texas, October 26 at 6 p.m.

ELMER S. BEST, *Registrar,*
801 Medical Arts Bldg.,
Minneapolis, Minn.

METROPOLITAN DENTAL SOCIETIES OFFICERS' CONFERENCE

THE second annual Metropolitan Dental Societies Officers' Conference will be held at the Rice Hotel, Houston, Texas, October 29.

CHARLES H. JAMIESON, *Chairman,*
8545 Gratiot Ave.,
Detroit, Mich.

MIDCONTINENT DENTAL CONGRESS

THE Midcontinent Dental Congress will be held in St. Louis, Mo., November 17-19.

VAL H. FREDERICH, *Chairman,*
Exhibit Committee,
Arcade Bldg.,
St. Louis, Mo.

GREATER NEW YORK DENTAL MEETING

THE Greater New York Dental Meeting will be held December 1-5 at the Hotel Pennsylvania, New York.

WALTER A. QUINN, *Chairman,*
Press & Publication,
Room 106A,
Hotel Pennsylvania,
New York.

ODONTOLOGICAL SOCIETY OF WESTERN PENNSYLVANIA

THE annual meeting of the Odontological Society of Western Pennsylvania will be held November 11-13 at the William Penn Hotel, Pittsburgh.

W. EARLE CRAIG, *Secretary,*
206 Jenkins Bldg.,
Pittsburgh.

PSI OMEGA

THE annual dinner of the Psi Omega Fraternity, National Alumni Chapter, will be held at 6:30 Monday evening, October 27, at the Lamar Hotel. A Mexican dinner will be served and there will be favors for the women in attendance. Headquarters will be maintained at the Lamar Hotel throughout the Annual Meeting of the American Dental Association. All members are requested to register at headquarters on arrival. A business meeting will be held at 10 a.m., October 28.

LLOYD H. DODD, *Secretary,*
National Alumni Chapter,
860 Citizens Bldg.,
Decatur, Ill.

SOUTHERN SOCIETY OF ORTHODONTISTS

THE next meeting of the Southern Society of Orthodontists will be held in Raleigh, N. C., September 29-30.

T. C. SPARKS, *Secretary,*
Medical Arts Bldg.,
Columbia, S. C.

FLORIDA STATE DENTAL SOCIETY

THE fifty-eighth meeting of the Florida State Dental Society will be held at the Hollywood Hotel, Hollywood, December 8-10.

WILLIAM P. WOOD, JR., *Secretary,*
442 W. Lafayette St.,
Tampa.

SOUTHERN CALIFORNIA STATE DENTAL ASSOCIATION

THE next annual meeting of the Southern California State Dental Association will be held September 8-10 at the Los Angeles Biltmore Hotel.

FRANCIS J. CONLEY, *Secretary,*
804 Professional Bldg.,
Los Angeles.

BOARD OF DENTAL EXAMINERS OF CALIFORNIA

THE next examination to be conducted by the Board of Dental Examiners of California for a license to practice dentistry in California will be held in San Francisco commencing December 15 at the Physicians and Surgeons College of Dentistry for the theory portion of the examination and at the University of California, College of Dentistry for the practical portion of the examination. All credentials must be in the office of the Secretary at least twenty days prior to the date of the examination. Address all communications to

KENNETH I. NESBITT, *Secretary,*
515 Van Ness Ave.,
San Francisco.

INDIANA STATE BOARD OF DENTAL EXAMINERS

THE next examination for licensure of the Indiana State Board of Dental Examiners will be held in Indianapolis beginning October 6 and continuing four days. All applications, fees and credentials must be in the hands of the secretary not later than ten days prior to the beginning date of the examinations. For applications, instructions and other information, address

D. GORDON LAMB, *Secretary,*
819 Chamber of Commerce Bldg.,
Indianapolis.

IOWA STATE BOARD OF EXAMINERS

THE Iowa State Board of Examiners will hold its next examination in Iowa City, December 15-19, for those desiring a license as dentist or as dental hygienist. Address Harry G. Bolks, secretary of the board, Sioux City, for instructions regarding registration for examination, etc.

STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

THE State Board of Registration and Examination in Dentistry of New Jersey will hold its annual examinations commencing December 8 and continuing for five days thereafter. On application to the secretary, a copy of the requirements and rules, instruction sheet and preliminary application will be forwarded. Any person desiring to become a candidate must file the preliminary application blank, together with the examination fee of $25 on or before September 1.

WALTER A. WILSON, *Secretary,*
150 E. State St.,
Trenton.

OHIO STATE DENTAL BOARD

THE next examination of the Ohio State Dental Board will be held at Ohio University, College of Dentistry, Columbus, the week beginning October 20. All applications must be in the hands of the secretary at least ten days before the examination. For further information, apply to

EARL D. LOWRY, *Secretary,*
79 E. State St.,
Columbus.

STATE OF WISCONSIN BOARD OF DENTAL EXAMINERS

THE next examination will be held December 15-19 at Marquette University Dental School, Milwaukee. Applications and information may be had by writing to the secretary. Applications and required fee must be at the secretary's office by December 5.

S. F. DONOVAN, *Secretary,*
Tomah.

DENTAL SUPPLIES FOR GREAT BRITAIN AND CHINA

THE United States Section of the International College of Dentists is sponsoring a movement to aid the dentists of Great Britain and China by providing them with badly needed supplies, instruments and small equipment used in the practice of dentistry. These will be collected and sent abroad by the Medical and Surgical Relief Committee of America. Any member of the dental profession or dental trade who can aid in this

movement by contributions of such material is asked to communicate with Mrs. Rodgers Balcom, executive chairman of the Medical and Surgical Relief Committee of America, 420 Lexington Ave., New York, N. Y.

ELMER S. BEST, *Registrar,*
Medical Arts Bldg.,
Minneapolis, Minn.

BRONX HOSPITAL VOLUNTEERSHIPS

THE Dental Department of the Bronx Hospital offers a number of volunteerships to recent graduates in dentistry in the following branches: oral surgery and anesthesia; surgical pyorrhea; orthodontia; root canal therapy, and operative dentistry. Those offering satisfactory credentials indicating their interest in the clinical study of dental surgery as a health problem will receive consideration. Address applications to the Dental Department, Bronx Hospital, Fulton Ave. at 169th St., Bronx, New York. Appointments will begin in July.

DAVID WURZEL, *Director,*
Dental Department.

CARNEGIE FELLOWSHIPS FOR RESEARCH AND GRADUATE WORK IN THE DENTAL SCIENCES

AIDED by the Carnegie Corporation, the School of Medicine and Dentistry of the University of Rochester offers scholarships paying $1,200-$1,800 per annum to well-trained dental graduates who are interested in research or who desire special training in the basic medical sciences as an aid to dental teaching or practice. A few fellowships also offer part-time training in oral surgery. On appointment, the applicant is given the title of Carnegie Dental Fellow and, according to his interest, works as a graduate student in one of the departments of the medical schools. Here, excellent laboratory facilities, adequate direction and close contact with various investigations related to medicine and dentistry help his research and study. Fellows are encouraged to attend medical classes, seminars and staff meetings and, when opportunity presents itself, to participate in class instruction and scientific meetings. Contact with the problems of clinical dentistry may be maintained through the Oral Surgery Clinic of the Strong Memorial Hospital and the Rochester Dental Dispensary. With the approval of the Graduate Council of the university, Fellows may prepare themselves for the degree of M.S. or Ph.D. Application should be made to

GEORGE H. WHIPPLE, *Dean,*
School of Medicine and Dentistry,
Rochester, N. Y.

POSTGRADUATE COURSE IN PRACTICE MANAGEMENT, SCHOOL OF DENTAL AND ORAL SURGERY, COLUMBIA UNIVERSITY

THE School of Dental and Oral Surgery, Columbia University, offers a course in practice management for qualified graduates in dentistry under the direction of George Wood Clapp, D.D.S., October 7, 9, 14 and 16 and November 6, 13, 18 and 25. Admission to the course is limited to members of the American Dental Association. For further information, address the assistant to the registrar, School of Dental and Oral Surgery, 630 W. 168th St., New York, N. Y.

CHICAGO COLLEGE OF DENTAL SURGERY ALUMNI BREAKFAST

THE Chicago College of Dental Surgery, Dental School of Loyola University, will hold an alumni breakfast during the meeting of the American Dental Association in Houston, Texas, October 29, at 7:30 a.m., in the South American Room of the Rice Hotel.

HENRY GLUPKER, *President,*
Alumni Association,
Chicago College of Dental Surgery,
1757 West Harrison St.,
Chicago, Ill.

NEW YORK UNIVERSITY COLLEGE OF DENTISTRY POSTGRADUATE COURSE IN INHALATION ANESTHESIA

E. A. ROVENSTINE, professor of anesthesia, New York University College of Medicine and Bellevue Hospital, and A. S. Mecca, assistant professor of oral surgery, New York University College of Dentistry and Bellevue Hospital, will give a course in inhalation anesthesia consisting of lectures and practical demonstrations Fridays for six consecutive weeks beginning October 3 and ending November 7. The course will deal with the theory and practice of general anesthesia in ambulatory cases and cases in private practice. Direct all communications to the office of the dean, New York University

Dental College, 209 E. Twenty-Third St., New York, N. Y.

THE CONNECTICUT DENTAL COMMISSION

THE Connecticut Dental Commission will meet in Hartford, November 25, 26, 27, 28 and 29, 1941, for the examination of applicants for license to practice dentistry and dental hygiene and to transact any other business proper to come before it. Applications should be in the hands of the recorder at least ten days before the meeting. For application blanks and further information, apply to Clarence G. Brooks, D.D.S., Recorder, New London.

NATIONAL BOARD OF DENTAL EXAMINERS

THE fifty-ninth annual meeting of the National Association of Dental Examiners will be held in the Sam Houston room of the Rice Hotel, October 25 and 26. At noon, October 25, a luncheon will be held in the French room on the mezzanine floor of the Rice Hotel, with a round table discussion on several important topics in the field of dentistry.

R. P. THOMAS, *Secretary*,
Francis Building,
Louisville, Ky.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING JULY 1941

July 1

No. 2,247,395, ROBERT NEIMAN. Investment.
No. 2,247,571, PAUL FRANCIS COLLINS. Dental investment composition.
No. 2,247,572, PAUL FRANCIS COLLINS. Dental investment composition.
No. 2,247,573, PAUL FRANCIS COLLINS. Dental investment composition.
No. 2,247,585, ROBERT NEIMAN. Investment composition.
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No. 2,247,587, ROBERT NEIMAN. Investment composition.
No. 2,247,588, ROBERT NEIMAN. Investment composition.
No. 2,247,968, SAMUEL Z. SOSTRIN and CYRIL J. DEMBICKI. Artificial tooth.

July 8

No. 2,248,469, ARTHUR E. SMITH. Syringe device.
No. 2,248,477, CHARLES F. LOMBARD. Method and apparatus for administering oxygen.
No. 2,248,532, ANTHONY F. HOFFMAN and HERMAN J. DETTMANN. Dental matrix band.
No. D-128,127, WILLIAM L. SCHMITZ, JR. Design for a dental profile recorder.
No. D-128,145, MAX ROSEDALE. Design for a display stand for toothbrushes.

July 15

No. 2,248,953, RAY BUNCH. Dental model trimmer.
No. 2,248,999, WILLIAM E. JOHNSON. Composition for lining dental plates.
No. 2,249,058, MARTIN STAUNT. Dental handpiece.
No. 2,249,694, SIDNEY WILLIAM WILDING. Material for taking impressions for dental or other purposes.
No. 2,249,721, JOHN H. MORRIS. Tooth and gum exerciser.

July 22

No. 2,249,890, GERARD GEORGE JOHAN DRÖGE. Process of making porcelain dental appliances.
No. 2,250,004, ROBERT R. BURTNER. Anesthetic preparations.
No. 2,250,005, ROBERT R. BURTNER. Anesthetic compounds.
No. 2,250,006, ROBERT R. BURTNER. Anesthetic compounds.
No. 2,250,058, PHILLIPS BROOKS. Dental implement.
No. 2,250,373 ROYAL S. HAGERMAN. Dental plate.
No. D-128,410, JULIAN H. BAIR. Design for a fountain brush.
No. D-128,411, JULIAN H. BAIR. Design for a fountain brush.
No. D-128,412, JULIAN H. BAIR. Design for a fountain brush.

July 29

No. 2,250,467, SAMUEL F. COLE. Syringe.
No. 2,250,758, CHARLES P. FRENCH. Fountain toothbrush.
No. 2,251,057, JOHN W. ISEMAN. Dental tool.

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